ENGINEERING NEWS
AND
AMERICAN RAILWAY JOURNAL.

VOL. XXIII. No. 3.

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ENGINEERING NEWS.

THE AMERICAN IRON AND STEEL ASSOCIATION Col. JAMES M. SWANK, General Manager, reports for 1889 as follows: It shows that there are now 575 completed blast furnaces in the United States, as against 582 two years ago. Quite a number of charcoal furnaces have been transferred to the abandoned list, leaving 146 of that class. A net decrease of ten in the number of anthracite furnaces has taken place, while there has been a net increase of twenty-five in the number which use bituminous coal and coke. There has been an increase in the annual capacity of blast furnaces from 10,990,993 net tons in 1887 to 13,168,233 net tons in 1889—an increase of 2,177,240 net tons in two years. There has been a net increase of 12 in the number of rolling mills and steel works, which aggregate 445, with 11 building. There has been an increase in the number of heating and puddling furnaces and trains of rolls. The annual capacity in finished iron and steel is now 9,215,000 tons, an increase of over 1,000,000 tons since 1887. There are now 41 standard Bessemer steel works with 88 converters. The annual ingot capacity is now 5,600,000 tons, exclusive of Clapp-Griffiths and Robert-Bessemer plants, as against 4,750,000 tons in 1887. The open hearth steel furnaces are 116 in number, with an annual capacity of 1,000,000 net tons. In addition to the works above enumerated are 27 bloomaries, 23 forges, 37 wire nail works, 55 wire rod and wire mills, 99 car building works, 118 car wheel works, 70 car axle works, 28 wrought iron pipe works, 35 cast iron pipe works and 25 locomotive works.

A GREAT SOUTH AMERICAN RAILWAY SURVEY is proposed by a company which has applied for a charter to the Virginia legislature and in which Mr, H. C. PARSONS, of Richmond, Va., is interested. It aims at a more rational substitute for the "Three Americas" railway in a line some 3,000 miles long, starting from Carthagena, U. S. of Colombia, and running nearly due south some 1,800 miles to Cuzco, Peru, from which a less distance over lines already built or projected would give direct rail connection with Valparaiso, Buenos Ayres, Rio Janeiro, etc. The line passes along the upper bank of the Amazon River, and it gives one a vivid idea of the magnitude of that stream to learn that even so near its headwaters it is almost a mile wide, and navigable westward for some hundreds of miles. A railway system of over 14,000 miles, nearly 12,000 already built or projected, would thus terminate at Carthagena, only five days from New York, bringing Valparaiso within some twelve days of it. A brief study of the map will show that the natural traffic of such a line would be very considerable.

THE FAIRHAVEN & SOUTHERN RAILROAD in the State of Washington, of which 26 miles are in operation and 91 miles are under construction, has its entire freight rolling stock equipped with the Westinghouse automatic brake and the M. C. B. automatic coupler, according to a letter recently received from an officer of the company. It is certainly a gratifying indication of progress in this reform when a new railway equips all its rolling stock with these appliances. Reference to the list in our issue of Dec. 21 shows quite a number of new roads which are equipping more or less of their cars with either the brakes or the couplers. Among others are the Alabama Midland, the Georgia Southern & Florida, the Choctaw Coal & Iron Co., in Indian Territory, the Oregon & Washington Territory, the Spokane Falls & Northern and the Seattle, Lake Shore & Eastern. The last three roads are in Washington while the first named are in the South. This speaks well for the standards of railway practice in both these sections.

THE PRIVILEGE OF "TRIMMING" THE SCOWS of the Street Cleaning Department of New York is worth $1,552 per week, or over $80,000 per year. Until the advent of Commissioner COLEMAN the city paid men $1.50 per day for doing this work. Mr. COLEMAN thought that the privilege of gathering up the tin cans, rags, bones, etc., might induce some one to trim them free of cost, and he first found men willing to do this, and later other men who would pay, for the privilege. The price bid per week advanced from $75 to $200, $400, $1,100 and last week to $1,552. The money thus collected goes into the sinking fund, however, instead of being applied where it belongs in street cleaning.

THE BLOCK SYSTEM is also to be put in use on about 22 miles of the "Big Four" between Cincinatti and Lawrenceburg Junction, Ind. There are ten block sections, the shortest being 1.1 miles long and the longest 3.1. The rules are similar to those in force on the Michigan Central, Wabash, and other single-track roads, but the semaphore is never to be lowered by a station operator, except by direction of the train dispatcher. Operators will, however, in case of failure of the wire, let trains follow under a caution signal after ten minutes.

THE MOUTH OF THE BRAZOS IMPROVEMENT is being pushed, but the teredo is said to be very troublesome, and some of the brush mattresses not covered by clay at once have been destroyed and will have to be replaced. Late soundings show 13 ft. of water in the shallowest part of the channel. Several thousand feet have yet to be built. The disagreement between the syndicate and GUS WILKE, the contractor, is reported as having been adjusted.

THE AUTOMATIC BLOCK SIGNAL SYSTEM, placed on the New York, Lake Erie & Western Railroad, and now in operation between Jersey City and Turner's, has worked so satisfactorily that it is to be extended to Port Jervis. Orders have been given for the building of the eight new signal towers required for the extension.

AN IRON-WOOD STREET PAVEMENT is being tested in Sheffield, England. A base of concrete is first put down and covered with a thin coat of asphalt. The iron is used in the form of upright, cruciform studs, with a broad circular base resting on the asphalt and the "cross" just level with the pavement top. The rectangular wooden blocks rest between these studs and are separated from each other on all sides by the width of the arms of the "cross." The space between the blocks is filled with pitch. The claim made is that the pavement affords a better foothold for horses than an all wood pavement. The cost is not stated and only 38 sq. yds. are laid.

FIFTEEN THOUSAND ELECTRIC LIGHTS were turned on for the first time on Jan. 1 in London. These are the first of the 50,000 lights now being put in by the Westinghouse Co. Every foot of the wire to supply this plant will be underground. The capital stock of the Metropolitan Electric Supply Co. of London, is $2,500,000 and its capacity will be 100,000 lights.

THE MOST SERIOUS RAILWAY ACCIDENT of the week was a derailment Jan. 9 on the Union Pacific Railroad at Sidney, Neb. It was apparently a similar accident to the one on the Chesapeake & Ohio Railway. A double-header fast mail train was wrecked by a broken rail; the cars were thrown down a bank, and two mail cars, with nearly 50 tons of mail, were destroyed. Three persons were injured. The accident is said to have been caused by a contracting broken rail.

THE NORTH RIVER BRIDGE BILL has been again presented to Congress by WILLIAM MCADOO, M. C. This is evidently the six-track suspension bridge plan of Mr. GUSTAV LINDENTHAL, C. E., before described in this journal. The capital stock is fixed at $10,000,000 with power to raise this to $40,000,000.

The incorporators named in the bill are GARRETT A. HOBART and E. C. P. YOUNG, President of the First National Bank of Jersey City; JORDAN L. MOTT, the big iron manufacturer; G. A. ROEBLING, of the Roebling Wire Works, Trenton; CHARLES J. CANDA, President of the Western National Bank, of New York; THOMAS J. RYAN, JOHN H. MILLER, JOHN KING-MCLANAHAN, JAMES ANDREWS, SAMUEL REA, W. T. SHUNK and PHILIP E. CHAPIN.

THE AQUEDUCT COMMISSION, at its last regular meeting, reported a total expenditure, to Dec. 31, 1889, on the New Croton Aqueduct of $22,356,211.23. Of this sum $18,534,495.84 was for the actual work of construction: the remainder for land appraisals, salaries, etc. The annual election resulted in the reëlection of Gen. JAMES C DUANE as president, JOHN A. TUCKER, vice-president, and JOHN E. SHEEHAN as secretary.

THE CHESAPEAKE & OHIO CANAL CO'S BONDHOLDERS have asked for the appointment, of a receiver to take charge of the canal and borrow money to put it in repair and to operate it. The bill filed in the Circuit Court of Washington Co. and Supreme Court of the District of Columbia, charges that the company is insolvent and ows $1,699,700 of bonds now due, with 25 years interest on them. The object of this bill is said to be to prevent the sale of the canal and to preserve it as a waterway.

THE GULF STREAM, says Gen. GREELEY, is not responsible for our abnormal weather, and in support of his opinion says that the abnormal temperature has been more marked in the Mississippi Valley than in the Atlantic States. According to his theory, the remarkable winter weather is all due to the storm centres of some time past following a path some 200 miles further north than in previous years. But he cannot ascribe a cause for this change in course.

THE CAPE COD CANAL is sought after by a New York syndicate which is reported to be willing to place $8,000,000 in the hands of the Treasurer of Rhode Island, as a guarantee of good faith. The same syndicate promises to go to work at once and finish the canal; establish a line of coal and passenger steamers; make a harbor of refuge at Barnstable, etc. The total force at work on the canal last year consisted of twenty men.

THE JAMAICA EXHIBITION of 1891 is to open in Kingston, Jamaica, Jan. 27, 1891, and will continue for three months. The exhibition is to include island products, manufactures, and works of art, together with exhibits from other nations and colonies. Articles will be received after Sept. 1, 1890, and nothing will be admitted after Dec. 1. Address LAURENCE R. FYFE, Esq., Secretary Jamaica Exhibition, Kingston, Jamaica.

THE LONDON & SOUTHWESTERN RAILWAY is rapidly completing the widening of its viaduct to six tracks from Waterloo to Nine Elms, about two miles. The Old Vauxhall Station, through which 850 trains per day pass, has also been entirely rebuilt. This work has been in progress for three years and will cost fully $1,150,000.

THE BEAR RIVER CANAL, in Utah, is reported as progressing finely, and about one quarter million dollars has been expended upon it. While excessive rains and snow has recently delayed work somewhat on the canal, the work on the dam has been pushed with vigor, says a correspondent.

THE NEW YORK ELECTRICAL COMMISSSION report 12,308 miles of wire now under ground. Of this total the Metropolitan Telephone Co. has 10,960 the Western Union, 578; the Edison, 252 and six other companies, 167 miles.

THE ARTESIAN WELL WATER OF ATLANTA, GA., is condemned by the Board of Health. They report that the increase in sewage salts from 1886 to 1888 was about 25 per cent. Since then the proportion has almost quadrupled.

A CURIOUS CAR-WHEEL EXPERIMENT, made by Master Mechanic MCKENNA, of the Indianapolis, Decatur & Western, has been, in its results, very satisfactory. Four years ago, when the I., B. & W. shops on the West Side were partially burned, a passenger car, undergoing repairs was also burned. The paper wheels were so scorched that the pulp would not hold the bolts. The wheels and tire being steel, and nearly new, he took out the burned paper, and substituted some solid yellow pine. The wheels have since run 200,000 miles. The steel tire had become so worn that lately he took it off and substituted a new tire. The wood in the wheels was found to be in as solid and perfect condition as when put in. Nevertheless we hardly believe yet that yellow pine centers are "the coming thing," although it would doubtless save much money if it could be used.

A BRIDGE OVER BEHRING STRAITS says the *St. James Gazette*, does not seem such an impossible thing in a day that furnishes a Forth Bridge and contemplates one over the English Channel. The narrowest part of the gulf separating Siberia and Alaska is only about 60 miles wide, and a string of islands in a straight line would reduce the actual waterway to about the width of the English Channel. The scheme, is said to be receiving serious attentions in Russia, and a projected railway from British Columbia to Sitka points in the same direction. The advantages of this inter-continental route are not very obvious, however, in view of the enormous expense of execution.

THE PRIVATE BILLS FOR PUBLIC WORKS, etc., in Great Britain, brought before Parliament this session number 243 or an increase of 36 over the number deposited last year. Of this number 117 relate to railways, docks, and canals, 27 to gas and water undertakings, 21 to tramways and subways, 7 to elpctric lighting, 32 are deposited by corporations, county councils, or local boards, and 39 are of a miscellaneous character.

THE DESERTS OF PERU ARE TO BE DITCHED, is Maj. A. F. SEARS, of Portland, Ore., can raise the money therefor. Maj. SEARS claims to have grants of several millions of acres of land from the Peruvian Government, located in the north of Peru. He believes this land can be redeemed by irrigation and is now in England to interest capitalists in a great irrigation and immigration scheme.

EMMENSITE is described by the Pittsburg *Leader* as a new explosive lately invented by Dr. EMMENS, of the village of Emmens, Pa. Its ingredients are not named, but the reported results of its efficiency and characteristics are wonderful—if true. A Pittsburg stock company is said to control this new explosive. The same inventor is reported to have made a smokeless powder of great power for use with ordnance and small arms. This is called "gelbite" which is described as ordinary paper saturated with the emmensite. The standard charge for a Springfield rifle is 25 grs. of "gelbite" as contrasted with 70 grs. of gunpowder.

THE U. S. CRUISER *Baltimore*, has been formally accepted by Sectretary TRACY and the American Navy now has eight new steel ships.

Performance of the Best Modern Pumping Engines, compared to that of the Cornish Pumping Engines in the Period of 1840.

By Prof. J. E. DENTON, Stevens Inst. of Technology.*

(*Continued from Page 4.*)

Regarding the application of the Multiple Cylinder principle to increase the economy of steam engines, the following general statements may be made:

I. The engines of steamships have taken the lead in the increase of boiler pressures and in the use of the greater number of cylinders, by means of which a given ratio of expansion has been secured. Also in the increase of piston speed and in general magnitude.

But stationary or land engines have embodied a higher degree of refinement in the distribution of the steam and the reduction of sources of minor wastes of heat.

For this reason and because of their ability to make use of the aid of fly-wheels to any desired extent, the land engines with one and two cylinders have afforded the same economy that has been obtained in marine engines with two and three cylinders, and equal or higher boiler pressures, and even greater economy in some instances.

II. Pumping engines have always enlisted the most advanced efforts at increased economy, and the most successful types compare with the steam engines of the present, in exceptional economy and original mechanical principles of action, as did the Cornish pumps with the engines of half a century ago.

When the leading type of marine engine was expanding steam about six times by the use of two cylinders with from 75 to 90 lbs. boiler pressure, the same extent of expansive action was used in a single cylinder on land, and represented the leading type of stationary engine in demand by the great industrial works, in which economy of steam was an important factor, as in the cotton mills for example.

The comparison of the economy of these two conditions of steam-using was a fruitful source of skepticism regarding the value of the theory that compounding, or the use of two cylinders, saved steam, because the range of temperature to which the metallic surfaces were exposed was made less, in each of the two cylinders, than in a single cylinder, and thereby the loss by cylinder condensation was less in the compound type. Marine engineers, by their universal adoption of the compound engine, made it certain that the latter was of superior economy to single-cylinder *marine* engines; but

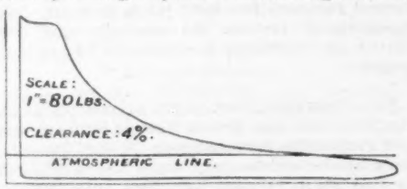


Fig 7. Single Cylinder Mill Engine.

comparisons of compound engines with stationary single cylinder engines, using equal boiler pressure and equal ratio of expansion, afforded no evidence of sensibly superior economy on the part of the compound engine. Conclusions of this nature are to be found in the more recent writings of BOURNE, and in D. K. CLARK'S Manual, the latter quoting the celebrated experiments of HALLAUER and his colleagues, which are a standard of method and accuracy in the measurement of engine performance. The fact of the matter is that, while undoubtedly the economy of these two types of engine does not sensibly differ, this fact is quite consistent with the truth of the theory of less cylinder condensation being secured by the compound principle.

In Fig. 7 is given a copy of a diagram from a Corliss condensing mill engine, expanding its steam about 6¼ times at about 75 lbs. boiler pressure.

Now, to obtain the same work from a compound engine, without altering the ratio of expansion or boiler pressure, we have simply to conceive that the steam, before entering the cylinder of Fig. 7, enters one of 3⅛ times less volume, in which it is cut off at about half stroke, if the clearance spaces aggregate the same per cent. in the two cylinders, and that it finally enters the original cylinder at about 10 lbs. above the atmosphere, and works with half cut-off. If the two cylinders are the same stroke, as is usually the case, the diameter will be in

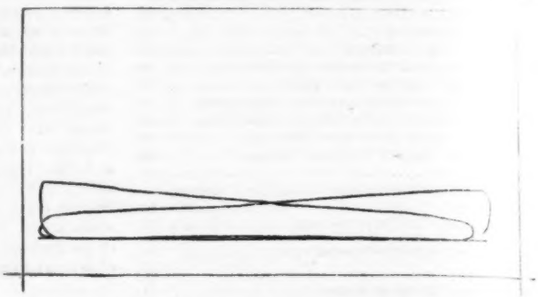


Fig. 6. Boiler Pressure 80 lbs. Revolution per Minute 82.
(*See page 4 of Jan. 4, issue.*)

the ratio of 3.5 to 1. The range of temperature due to expansion will now be about 45° F. in each cylinder, whereas it was 110° in the single Corliss cylinder. The time of admission of steam, previous to cut-off, will be that of one-sixth of a revolution for the compound, whereas it was one-tenth for the single engine. The surface to which the steam exposed during admission will be two-thirds as much in the compound as in the single engine. A comparison of the product of these factors makes it probable* that the cylinder condensation per stroke is about 0.45 as much for the compound as for the single engine.

The latter uses about 18.5 lbs. of steam per hour per H. P., which is 140 per cent. of the amount corresponding to the absence of condensation. Hence the compound should consume 1 + 40 x 0.45 = 1.18 per cent. of the same amount, assuming equal losses by clearance.

But there is a still further reduction of steam due the compound, on account of the lesser clearance wastes.

In the single engine the clearance of 4 per cent. is practically all wasted, as little or no compression is practised. Hence, as the whole consumption is represented by 0.16 of the stroke, the waste is 4-16 or about 25 per cent. of the whole volume of steam admitted, whereas in the the compounded system volume of the clearance spaces in connection with the boiler is only 1-3.5 part of the same space, and it is practical to cushion the steam so that only about ¼ of the clearance space is wasted. Hence the clearance waste is only about 1-10.5 part of that for the single engine, assuming equal *percentage* of clearance. The marine practice, has, however, been very lavish of clearance spaces, and the latter runs as high as 12 per cent. Assuming the clearance at 8 per cent., it follows that, by virtue of clearance, the consumption in the compound should be but 84 per cent. of that for the single engine.

Hence the consumption of the compound should be 0.84 x 118 = 99 per cent. of the steam required to fill the admission space without cylinder condensation. The latter amount is equivalent to about 14 lbs. per hour per H. P. Why is it then that the actual consumption is about the same as that of the single engine, or 18.5 lbs. per H. P.?

The reason is evident from an inspection of Fig. 8. This represents Fig. 7 in the dotted line *C D E F G*, etc., to a coarse scale, together with the cards from a marine compound engine, Figs. 9 and 10, superimposed upon it. The same volume of steam *B D* is

* I wish to emphasize the fact that it is not intended to propose this calculation as one of mathematical precision. To estimate exactly the amount of cylinder condensation is beyond the domain of mathematics, as the physical conditions are too intricate. The method is simply an approximate one, which is useful in a general way, and is not controverted by any exact data which have come to my notice.

present at cut-off for both engines, but the work obtained from the expansion is widely different.

At the point *E* the steam in the compound escapes from the high cylinder and expands into the receiver. The steam does work upon itself, and may be imagined to expand, according to the adiabatic* law, along *E H*, but as the high piston is at rest during this action, no useful work is performed. Consequently there is a loss of mean effective pressure in the compound, represented by at least the area *E F G H I K L*, with certain small additions due to the greater clearance in the low cylinder, and reduced by the effect *A B C* of the subdivision of the clearance in the high cylinder.

Now such losses of area amount to 17 per cent. of the single engine card area, in the case of Fig. 8.

The compound cards are, however, exceptionally perfect and the clearance usually low. With the average cards of marine practice, the losses amount to fully 20 per cent. of the area of the card of single engine. Consequently the actual consumption of the compound engine per H. P. is $\frac{99}{0.8} \times 14.0 = 17.5$ lbs., or *practically the same as the single engine*, taking into account the approximate character of the computation of the cylinder condensation.

It is therefore quite consistent that stationary mill practice should never have been able to find, in the performance of the marine compound engine, using steam at about 75 lbs boiler pressure with six expansions, any *definite* proof that a superior economy was thereby obtained over the single-cylinder condensing engine using the same boiler pressure and ratio of expansion. And the same is also true of the single-cylinder engines of BAIRD'S design in use on the Cromwell Line steamers, *Hudson* and *Knickerbocker*. The latter use steam with six expansions, and high pressures, and have practically the same economy as the marine compounds, a fact long regarded as paradoxical to the theory of less cylinder condensation with the compounds, whereas the latter, as shown, may be admitted to realize all of the less cylinder condensation due the theory of subdivided temperature, and yet be simply the equal of the Baird engines through loss of pressure between the cylinders.*

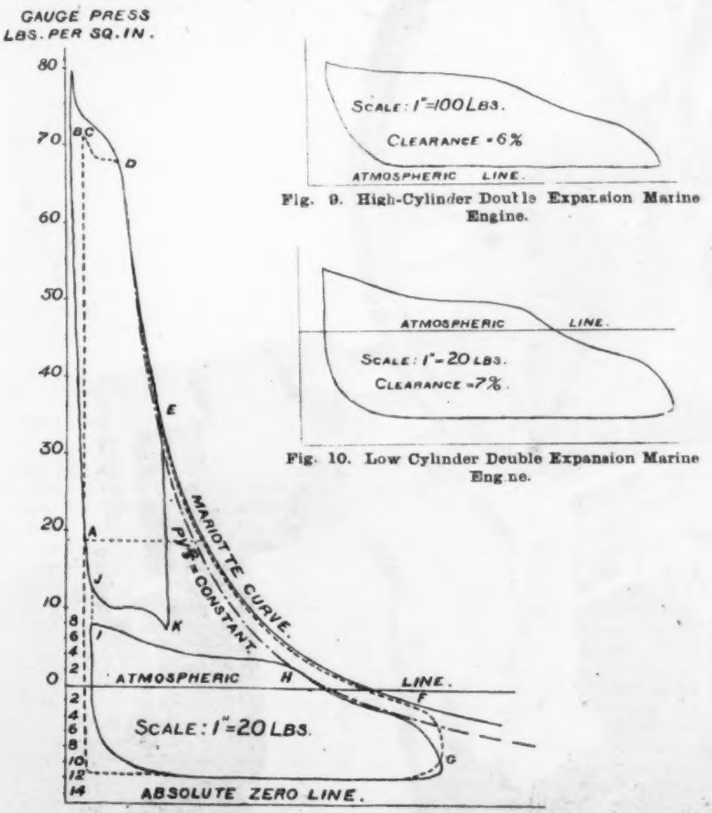


Fig. 8. Figs. 7, 8, and 9 Combined.

Fig. 9. High-Cylinder Double Expansion Marine Engine.

Fig. 10. Low Cylinder Double Expansion Marine Engine.

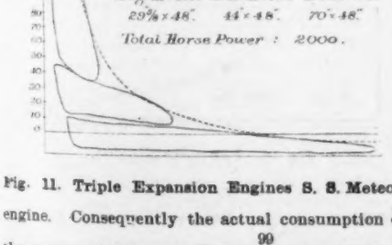

Boiler Pressure: 135 lbs.
Revolutions per Min.: 72.
Cylinders:
High Press. 29½ × 48".
Intr. Press. 44 × 48".
Low Press. 70 × 48".
Total Horse Power: 2000.

Fig. 11. Triple Expansion Engines S. S. Meteor.

When, however, the marine compound is compared in economy with the *marine* single-cylinder engines in general use previous to the advent of compounding, we have entirely different conditions from those discussed above. The change from single to compound in this case involved the *increase of the ratio of expansion from less than two to about six.* Hence there was a gain of theoretical economy of from 20 to 33 per cent. by virtue of the *principle of expansion*, in addition to the gain due to less cylinder condensation discussed above. For example, when a paddle-wheel beam engine, using steam of 35 lbs. boiler pressure at half cut-off, is compared to a screw boat driven by compound engines using steam at 75 lbs. boiler pressure, and with six expansions, the gain due the expansion principle may easily more than offset the loss of pressure between cylinders, leaving the gain due to less cylinder condensation to be fully realized. The result should be a saving of fully 25 per cent., and practice never had any difficulty in recognizing that such is actually the fact. A similar margin exists when a high-pressure single-cylinder tug-boat engine, affording less than two expansions, at 50 lbs. pressure, is compounded to secure six expansions by aid of a condenser, and five higher boiler pressure.

The leading type of marine engine now uses three cylinders, or is of the triple expansion character, the boiler pressure is about 150 lbs. and the piston speed 900 ft. per minute in the fastest cases. Exact measurement of the economy of such engines, at the higher limits of speed, has not been made, but their steam distribution is fairly represented in Fig. 1 the diagrams of the several cylinders being combined so as to exhibit the continuous expansion of the steam, and the losses of work due to the transfer of the vapor from one cylinder to the next larger one. The steam is expanded about eleven times. The diagrams shown are from the steamer *Meteor's* engines. The latter are of 2,000 H. P. and run at about 600 ft. of piston speed per minute. Accurate measurements of the performance of this engine (by a committee of the British Society of Mechanical Engineers, of which Prof. ALEX. KENNEDY was chairman) show that steam consumption per hour per indicated H. P. is 15 lbs.

No greater economy is to be expected from larger powers of this type of engine, simply on account of greater dimensions, as experiment has shown that the decrease of the per cent. of cylinder condensation, due to the use of cylinders greater than about 4 cu. ft. of capacity, is practically imperceptible.

The greater piston speed of the cases of triple expansion engines making 900 ft. per minute, as in the case of the *City of Paris*, etc., may afford less steam per H. P. than the 15 lbs. found for the *Meteor's* engines; but the case of the *Meteor*, which represents the average piston speed of triple engines, will afford a sufficient basis for comparison with the most advanced land practice.

It is evident from the mere inspection of the indicator card of the engines of the *Meteor*, Fig. 11, that there is a considerable loss of pressure between cylinders. The dotted expansion curve is the adiabatic or hyperbola, whose equation is $p.\ v.^{\frac{10}{9}} = \text{constant}$. A single cylinder card affording the same ratio of expansion would practically coincide with the Mariotte curve, and if there was no cushioning, its left-hand boundary would be a vertical line tangent to the inner end of the low card. Imagine such a line drawn, and the mean pressure of the Mariotte card for the single cylinder action determined. The result is that the actual mean effective pressure of the triple engine is but 86 per cent. of the single cylinder card. The clearance of each cylinder is about 12 per cent of its piston displacement. The ratio of the volume of the high and low cylinders is 5.7, and the steam is cushioned in the high cylinder to about half the boiler pressure. The waste of steam by clearance is therefore equivalent to about 1 per cent. of the low cylinder volume. Hence the action of the steam in the engine is as a whole equivalent to obtaining about eleven expansion in a single cylinder having one per cent. clearance, with a loss of mean effective pressure of 14 per cent., the practical result of which is that each indicated horse power consumes 15 lbs. of steam, or about 280 thermal units per minute, for 100° F. temperature of feed water.

While marine engines have thus adopted three cylinders, and thereby reduced the steam consumption to 15 lbs. per H. P. from the 18.5 lbs. of steam consumption afforded by the two-cylinder engines, the single-cylinder land rival of the latter has given way to a two-cylinder compound type of engine, which, by the use of about 120 lbs. of boiler pressure, and about 18 expansions, has attained an economy of less than 14 lbs. of steam per indicated horse power, and is now the well-established successor to the single-cylinder condensing mill engines of New England.

In this movement pumping engines have pioneered the way, for undoubtedly the practice has originated from the success attending the use of steam under about the above conditions in the pumping engines, designed for the cities of Lynn and Lawrence by MR. E. D. LEAVITT, about thirteen years ago. The distribution of steam in the Lawrence engine is shown in Fig. 12.

The high and low cards are combined so as to exhibit the expansion in both cylinders as a continuous operation. The dotted line is a Mariotte curve.

* The coincidence of the hyperbola $P\ V^{\frac{10}{9}} = \text{const.}$ with the actual cards is merely the accidental result of the miscellaneous losses due to friction, and condensation as the steam expands through the clearance spaces.

* Another example is found in the pumping engines of the Pittsburgh Water-Works, where the low cylinders of compound engines affording about six expansions, at 100 lbs. boiler press, were abandoned in favor of the use of the same ratio of expansion in the high cylinder, at about 25 lbs. higher boiler pressure. The economy of fuel is practically unaltered, but the absence of the care of the low cylinder makes the change an improvement on the whole.

The boiler pressure is about 105 lbs. and the ratio of total expansion about 22 lbs. Both cylinders are steam-jacketed with steam of boiler pressure. The high cylinder is 28 ins. x 8 ft. stroke, and the low cylinder 38 ins. x 8 ft. stroke. The cylinders operate on the Wolff principle, being placed side by side, as close together as possible. Both cylinders work on to a walking beam whose motion is controlled by a crank and heavy fly-wheel. The engines turn about 13½ times per minute, the steam and pump pistons having a speed of 216 ft. per minute. These engines were the first to accomplish the feat of performing *average annual* duties exceeding 100 million foot lbs. per. 100 lbs. of coal. The steam consumption per indicated horse power of the Lawrence engine, as recorded by Mr. R. H. BUEL,* was 16.48 lbs. Supplemented by the splendid boiler performance of 10.13 lbs. evaporation, this consumption of steam yielded a duty of 111 millions, the efficiency of the mechanism being 91 per cent. The steam per H. P. does not represent extraordinary economy, viewed from the standpoint of the performance of the best engines of the present, but the action of the steam, as shown by the cards, marked an epoch in compounding; for the losses of pressure between the cylinders, which had been the target of criticism and so serious a handicap against the compound principle, are *entirely avoided in these engines*, compared with single-cylinder action. It will be noticed, in Fig. 12, that in the first place the expansion line of the compound card either coincides with or lies *outside of the Mariotte curve*, thus showing that the steam condensed in the cylinders was utilized by re-evaporation to so great a degree that *more steam* appeared as vapor in the low cylinder than was present at release in the high cylinder. Also if the mean effective pressure of the actual cards be compared with that of a Mariotte card of equal ratio of expansion for a single cylinder, the result is that the engine realized 106 *per cent of the mean effective pressure* of such a card, while the loss by clearance waste is as though the single engine had only 0.3 per cent *of clearance*. The degree of perfection exhibited by these cards has never been equalled except at the hands of their distinguished originator in other engines; but, under the stimulus of what was here accomplished by the rare genius of LEAVITT, in avoiding the loss of pressure between cylinders and the attainment of what was then

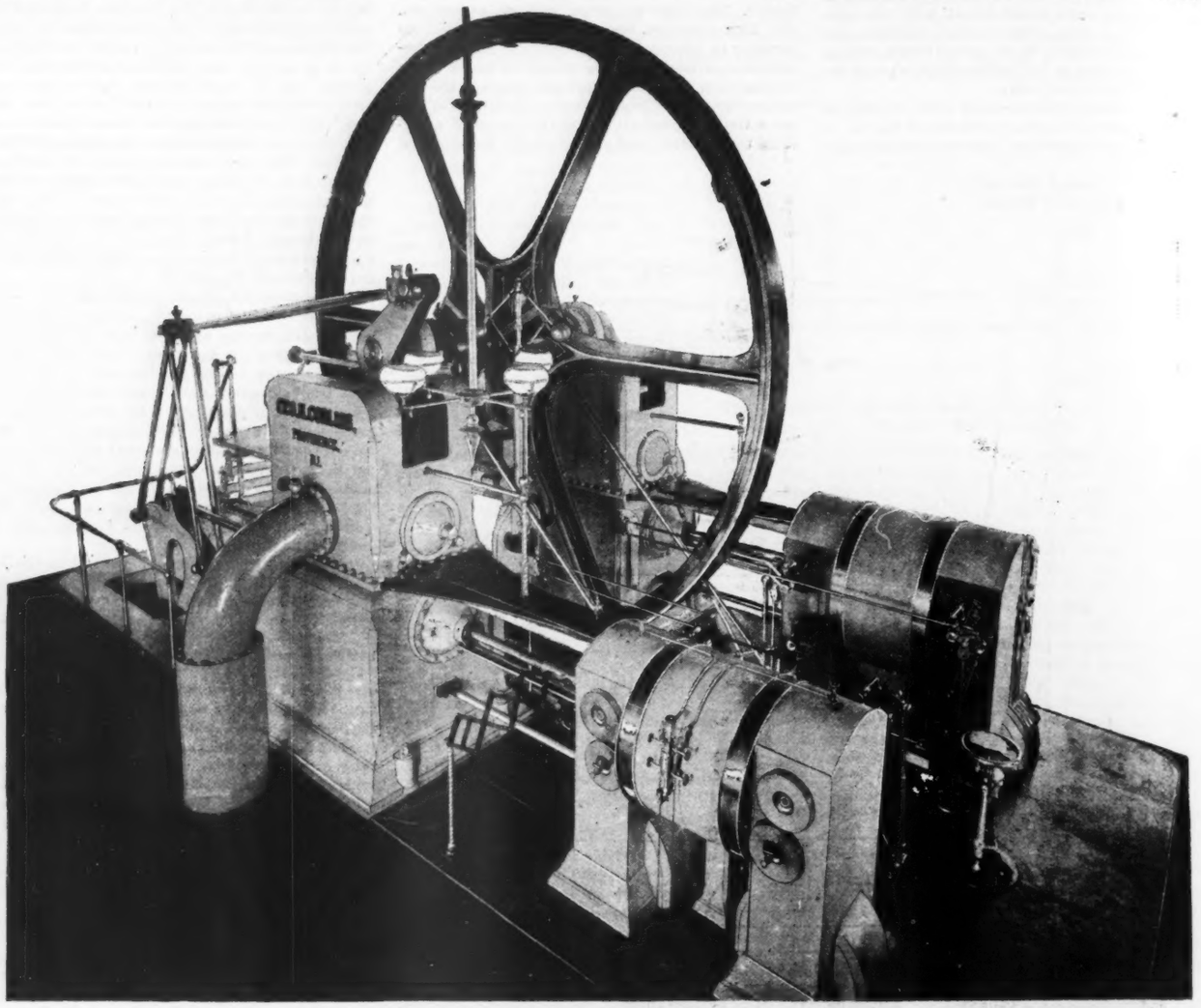


Fig. 13. Pumping Engine at the Pawtucket Water-Works.

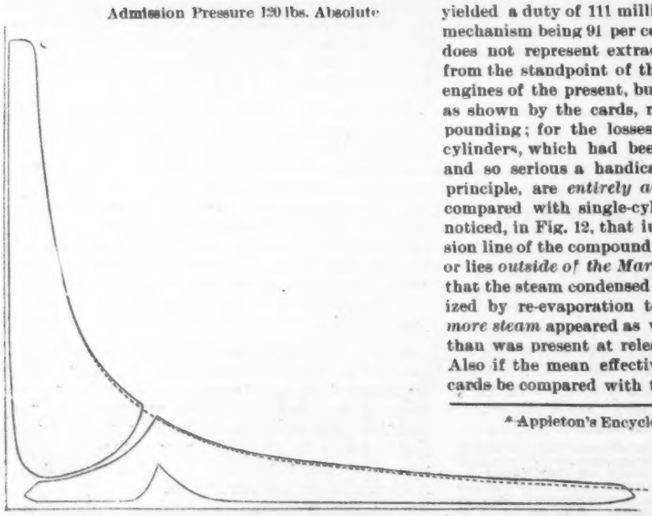


Fig. 12. Lawrence Pumping Engine. (Dotted Line = Mariotte urve)

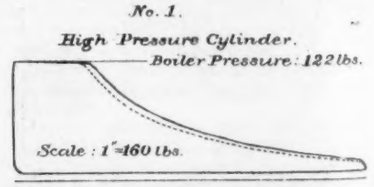


Fig. 14. Pawtucket Engine.

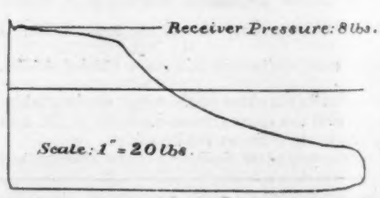


Fig. 15. Low-Pressure Cylinder Pawtucket Engine.

* Appleton's Encyclopædia of Mechanics.

exceptional economy of steam, MR. GEORGE H. CORLISS produced the well-known Pawtucket Pumping Engine in 1879. This is an engine of about 150 H. P., the same capacity as each of the pair of LEAVITT engines at Lawrence, but of smaller dimensions, the power being made up by greater speed of revolution. Its general arrangement is

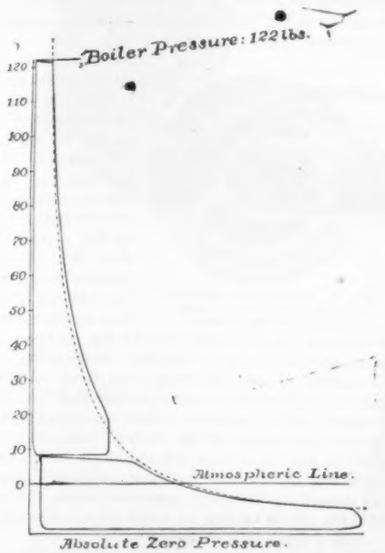


Fig. 16. Pawtucket Pumps. Dotted Line = Adiabatic Curve.

shown in Fig. 13. The pistons work under control of the fly-wheel through cranks at right angles. The cylinders are 15 and 30¼ ins. diameter and 30 inches stroke. The speed of rotation is about 50 per minute, making the steam and pump pistons move at about 250 ft. per minute.

The steam exhausts from the high cylinder into a receiver of four times the latter's volume. Both cylinders are jacketed on heads and sides with steam of boiler pressure. The latter averages 125 lbs. above the atmosphere, and is expanded about 18 times, as shown by Figs. 14, 15, and 16. The receiver is not jacketed, but the water is drained from it into a trap and thence pumped through a collection of pipes forming a heater lodged in the flue, through which the gases from the furnace pass, on their way to the chimney. A study of the combined cards, Fig. 16, shows that the action of the steam does not maintain the expansion at the efficiency of the Mariotte curve, during the movement of the low piston, the dotted lines shown being the $p.\ v.^{1.0} =$ constant, hyperbola. Only about 87 per cent. of the steam present at release in the high cylinder appears at cut-off in the low cylinder.

There is therefore considerable loss of area compared to a Mariotte card, during expansion in the low cylinder; but this is so much more than made up by the additional area due to subdivision of clearance in the high card, that is the area at the left of a vertical line tangent to the low card, that, on the whole, the mean effective pressure is 101 per cent. of that of a Mariotte card having the same clearance as the low cylinder. The clearance is 3.67 per cent. for the low and 4 per cent. for the high cylinder. Hence the total distribution is equivalent to the realization of 101 per cent. of the effect of a Mariotte card in a single cylinder having 0.8 per cent. of clearance, and expanding the steam about 18 times. The distribution is therefore less perfect than that of the Lawrence engine, a fact probably due to the absence of the compression in the low cylinder of the Pawtucket, an action which is fairly complete in the Lawrence cards. Nevertheless, the economy of the Pawtucket engine is superior to that recorded for the Lawrence engine, the steam per H. P. being from 13.6 and 13.8 lbs. by two consecrative trials, and the duty 124,700,000 ft. lbs., with a boiler performance of but 8.88 lbs. evaporation. This can be attributed to the less degree of cylinder condensation during admission to the high cylinder, on account of the higher rotational speed* in the Pawtucket engine, and possibly slightly to the greater range of temperature to which the high cylinder of the Lawrence engine is exposed by the absence of an expansion valve on its low cylinder. The cylinder condensation calculated from cut-off is for the Lawrence engine about 45 per cent. of the total steam and about 28 per cent. for the Pawtucket engine.

The success attending Mr. CORLISS' efforts in the design of the Pawtucket pumping engine led him to introduce the same construction in mill practice as a substitute for his single cylinder condensing engines, using about six expansions, then almost universally used throughout the New England cotton mills. A 600 H. P. engine, for the Nourse mill at Woonsocket, R. I., was built on the same lines and principles as the Pawtucket pump, and the favorable effect produced by this engine led to the general introduction of its type. Steam consumption for these engines, based on tests, is quoted from 16 to 13 lbs. per hour per indicated H. P., varying with the different conditions of loading, conditions of tightness of the valves, etc. No measurement of the *steam consumption* of the Corliss engines of this type has, however, been made, the tests being confined to the determination of the coal per H. P., thus leaving unknown the extent to which the boiler was responsible for the record of 1.63 lbs. of coal per hour per H. P., obtained with the Woonsocket engine and the Pawtucket pump in tests thereof. As the re-evaporation of the water drained from the receiver by the flue heater was an exclusive feature of the Corliss construction, tests of the steam consumption of other makes of this type of compound do not determine the value of this refinement, and the writer had been for several years desirous of measuring the *steam consumption* of the Corliss design, which has its greatest success in the Pawtucket pumping engine. The latter, during the eight years following its erection in 1879, *averaged* an *annual* duty of about 108,000,000 per 100 lbs. of anthracite coal, running about 13 hours daily, and including coal for banking and starting. Its running time has averaged about 270 days per year during eleven years.

But during the year ending December, 1888, the engine ran 338 days, averaging 22.33 hours per day, and by the less waste from banking and starting fires which such continuous operation secured, the annual duty was increased to 124,500,000 ft. lbs. per 100 lbs. of coal, including coal for all purposes except heating the building.

As such a performance was extraordinary, and indicated that the engine was still in its best condition, the writer requested permission to verify the duty claimed and at the same time secure the desired data regarding the value of the various refinements of the design, the guarantee being made that no expense should ensue to the Water Works Department. Such permission was cordially granted by the Superintendent of the Water Works, Mr. EDWIN DARLING, who together with Mr. JOHN WALKER, the Chief Engineer, provided every facility for the most complete investigation desired.

(TO BE CONTINUED.)

* The product of the surface to which steam is exposed during admission to high cylinder, multiplied by the time of admission, divided by the volume of the steam admitted, is for the Lawrence engine 2½ times as much as for the Pawtucket engines. Assuming equal range of temperatures, this ratio roughly measures the relative percents of cylinder condensation expressed in terms of the steam accounted for by the indicator as unity. The actual value of the same ratio is by experiment 2¼.

Two Steam Separators.

We illustrate herewith two new types of steam separators for attachment to steam pipes to extract from the steam the entrained and condensed water, thus avoiding the danger of breaking the engine by the passage of water into the cylinder, and at the same time adding very considerably to the economy of the steam plant.

In the case of boilers which have poor circulation, which are overworked, or which have feed water containing a considerable percentage of impurities, priming is a frequent cause of trouble to engineers and of the straining or breaking of engines through the collection of the condensed water in the cylinder. Besides this, however, practically all saturated steam contains more or less water held in suspension in a finely divided state, or "entrained," and if the steam pipes be of any considerable length, condensation from the colder air outside the pipe will cause water in considerable quantities to collect on its interior.

With regard to the percentage of entrained water in steam, the following interesting figures are given by the Stratton Separator Co.

As early as 1830 Dr. W. T. HAYCRAFT, of England, was led by comparing the work done by a pound of steam with its theoretical energy, to make an extended series of experiments, in order to determine in what stage of the process of transforming heat into power the great losses took place. In using a surface condenser, he discovered that the amount of water collected in the hot well was considerably in excess of that which theoretically should correspond to the volume of steam passing through the engine, as measured by the displacement of the piston.

This led him to the further discovery that during evaporation a large percentage of unvaporized, or as it is now termed entrained, water was mechanically carried along with the steam. Upon watching the process of ebullition, this was easily explained and is most readily seen when boiling water in a glass beaker.

It will be noticed that the bubbles of steam, as they come to the surface, raise a film of water, which upon

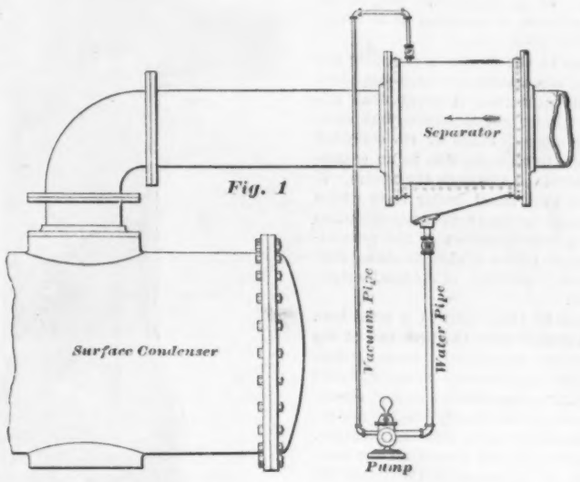


Fig. 1. Barnard's Steam Separator Attached to Surface Condenser.

the breaking of the bubble is thrown up in a spray of very fine particles. When evaporation is slow, these may drop down to the surface again, but under pressure these globules of water are still more minute; and if we reflect how air, when perfectly still, in foggy weather, holds in suspension an enormous amount of water, it will be understood how readily a swift current of steam will carry away these particles of entrained water.

Many experimentalists have endeavored to determine the amount of entrained water in the steam from boilers working under fair average conditions. ZUENER'S experiments show from 7½ to 15 per cent. The least Mr. A. HIRN found was about 5 per cent. The United States Centennial Commission on Boiler Tests stated that an amount equal to from 3 to 4 per cent. cannot be detected by ordinary observation, and found instances of as high as 18½ per cent. of water in the steam.

As to the rate of condensation of steam in pipes, the following figures are given by the company:

In an elaborate series of experiments made in 1859, Mr. BURNAT found with steam of only 30 lbs. pressure, with pipes exposed to a perfectly still atmosphere kept at a uniform temperature of 60°, that a bare pipe condensed as much as 0.72 lb. of steam per sq. ft. of surface per hour, while the same pipe, properly protected, still condensed about one-half as much. TREDGOLD, CLEMENT, GROUVELLE, and NICHOL found results somewhat less, but they average for steam of 60 lbs. pressure more than ½ lb. of water per sq. ft. of surface per hour.

If we suppose a 4-in. pipe, 60 ft. long, the condensation will amount to 30 lbs. of water per hour, or ½ lb. per minute, and when exposed to draughts or in winter weather it will be yet greater.

The effect of water in the steam in reducing the economy of working is a matter to which engineers have paid too little attention. A great deal has been written on cylinder condensation, but comparatively little reference is made by the standard authorities to the loss in economy due to an excessive percentage of entrained water in the steam. It is a well-known fact that in all boiler tests which pretend to be accurate, the apparent evaporation has to be corrected by a determination of the percentage of entrained water, which as already stated may often amount to 10 to 15 per cent. of the total weight of water evaporated.

The heat contained in this water is a total loss, and it is further claimed that the presence of the water tends to increase the cylinder condensation. the wet steam imparting its heat to the cylinder walls more readily than superheated or dry steam.

We illustrate herewith two separators for removing condensed or entrained water from steam pipes, The first has been invented and placed on the market by Mr. GEO. A. BARNARD, of 15 Cortlandt St., New York, a member of the American Society of Mechanical Engineers.

It consists of a horizontal cylindrical shell fitted at the bottom with a sloping channel way open to the shell. (See Fig. 2.) In this shell are placed a number of "baffle plaits" set at an angle and supported by rings fitting the shell. The plates of one ring come opposite the ports of the next, compelling the steam to take a tortuous course through the shell, and to impinge against the baffle plates. The entrained water, coming in contact with the bars and rings, runs down through cored holes at the bottom of the bars into the sloping pocket and thence to the discharge pipe at the bottom, where it is drained off. (See Figs. 3 and 4.) To avoid undue obstruction to the passage of the steam and reduce at the same time its velocity, the "port-area" of each baffle-plate is considerably in excess of the cross-section area of the steam-pipe.

Fig. 1 shows a special arrangement of the device for use with surface condensers. It is well-known that the vacuum extending from the condenser to the engine cylinder will "hold up" the condensed water and oil collected by a separator. In the arrangement shown, the waste-pipe from the separator is connected to the suction chamber of a pump This places the suction valves of the pump in equilibrium and enables the pump to continuously draw off the oil and water. The efficiency of this separating device is said to be such that no filtering tank is needed, other than the ordinary hotwell, which may be of limited capacity sufficient to afford solid water for the boiler feed pumps to draw on. The advantages of separating the oil or grease from the exhaust steam, that after condensation (either in a surface condenser or steam heating coils) is used for boiler feed water, are well known to engineers. Where the separator is used on live steam pipes, an ordinary steam trap may be connected to the discharge pipe, returning the water directly to the boiler. The shell of the separator is made of cast iron in the smaller sizes and of wrought iron or steel, according to the pressure carried, in the larger sizes.

We also illustrate a very ingenious separator placed on the market by the Stratton Steam Separator Co., of 32 Cortlandt St., New York City.

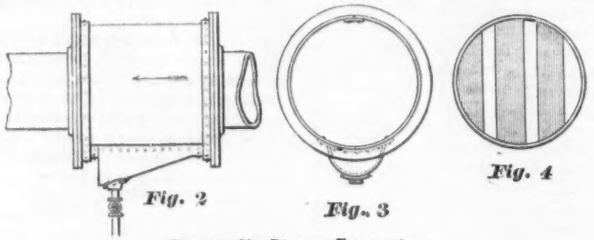


Fig. 2 *Fig. 3* *Fig. 4*

Barnard's Steam Separator.

This device is based on the principle that, if a rotative motion is imparted to the steam, all the liquid particles it may contain, being heavier than the steam, acquire centrifugal force and are projected to the outside of the current.

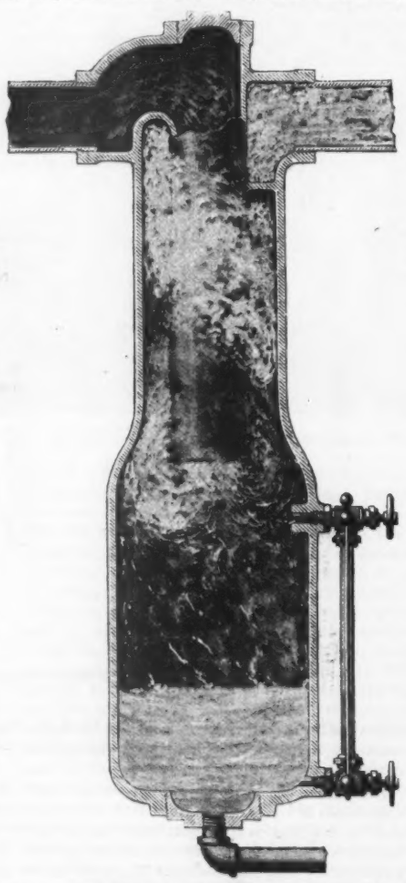


Fig. 5. The Stratton Steam Separator; Vertical Section.

This separator, shown in vertical section in Fig. 5, consists of a vertical cylinder with an internal central pipe, extending from top downward, for about half the height of the apparatus, leaving an annular space between the two. A nozzle for the admission of the steam is on one side, the outlet being on the opposite side or on top as may be most convenient in making the connections.

The lower part of the apparatus is enlarged to form a receiver of considerable capacity, thus providing for a sudden influx of water from the boiler. A suitable opening is tapped at the bottom of the apparatus for a drip connection, and a glass water gauge shows the level of the water in the separator at all times.

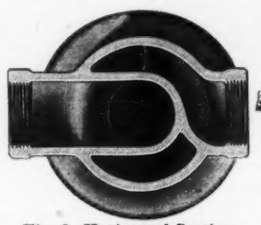


Fig. 6. Horizontal Section through the Steam Pipes at Top of Separator.

The current of steam on entering is deflected by a curved partition as shown in Fig. 6, and thrown tangentially to the annular space at the side near to top of the apparatus. It is thus whirled around with all the velocity of influx, producing the centrifugal action which throws the particles of water against the outer cylinder. These adhere to the surface, so that the water runs down continuously in a thin sheet around the outer shell into the receptacle below. while the steam, following a spiral course to the bottom of the internal pipe, abruptly enters it, and in a now dry condition passes upwards and out of the separator, without having once crossed the stream of separated water, all danger of the steam taking up again such water after separation being thus entirely avoided.

The separator is made automatic by connecting to a steam trap, which if desired may return the condensed water to the boiler. But in cases where the accumulation of water is small, the separator may be emptied of condensed water occasionally by the engineer, and the expense of the steam trap saved. The fact that the separator can be emptied by hand is also a great advantage where a steam trap is used in case the trap becomes clogged or inoperative.

The Stratton Separator is made of cast iron in the smaller sizes and of wrought steel for 8.-in. and larger sizes.

Besides the ordinary use of the separator between boiler and engine or between engine and condenser, already mentioned, the Stratton Separator Co. call attention to the fact that the use of a separator between the high and low pressure cylinders of a compound engine has been found advantageous and conducive to economy.

As the low-pressure cylinder takes steam from the receiver, the pressure and temperature in the latter become reduced in proportion, so that when the exhaust from the high-pressure cylinder enters, its temperature is higher than that of the receiver steam. As it expands down to the normal receiver pressure, a surplus of heat is left, which, were the steam dry, would produce superheat; but as the entering steam contains all the water due to condensation in the first cylinder, this extra heat merely serves to evaporate a fraction of such water.

On long lines of pipe, particularly where much exposed, on superheaters, to economize fuel, and on plants where the boilers have to be forced beyond their proper capacity, the use of the separator is especially advantageous.

Besides its use on stationary plants, the Stratton Separator has been introduced into marine service, and the *Atlanta*, *Boston*, *Chicago*, *Kearsarge*, *Yorktown*, and other vessels of the United States Navy have been fitted with it.

The Trotter "Curve Ranger."

We extract from *Engineering* the following cuts and description of a hand instrument invented by Mr. A. P. TROTTER for running in or "ranging" curves. The instrument is intended to perform all the operations of curve-ranging with little or no calculation by the operator, as the chord, arc, versed sine, and many other quantities can be read direct from the scales. The instrument is really a modification of the ordinary sextant. It is thus described:

At *A*, Fig. 1, is a mirror, only the upper half of which is silvered. This mirror moves with the up-

per scale, and is provided with a vertical cross-line. The figure of the curved edge of the upper scale is a polar curve, whose equation is,

$$r = a + b \sin 2\theta$$

where a is the distance from the zero graduation to

The Trotter Curve Ranger.

the axis of the mirror, and b is the length of the scale from zero to 2, and θ the inclination of the mirror. At B is an eye-piece. Suppose then it is intended to range a curve between the points A B, Fig. 6. Then A and B being given, the curve connecting the two is determined by any one of the following seven quantities, all of which can be obtained from the scales of the instrument. The radius $X B$, the length of the arc $A C D E B$, the versin. $D K$, the angle at the center $A X B$, the angle $F A B$ between the chord and a tangent, the angle $A O B$ between the tangents, or the tangential angle $O A B$. If the radius is chosen, say 10 chains, then the ratio of chord to radius is $\frac{15}{10} = 1.5$.

Then the graduated edge of the curved limb is set to cut the center line engraved on the body of the instrument (marked ratio of chord in radius) at 1.5, and clamped in this position by a thumb-screw provided for the purpose, being finally adjusted exactly by a tangent screw in the usual way. Let any position such as C, be taken up and the instrument held in the hand; then if the point C is on the curve, both A and B can be seen simultaneously through the eye-piece of the instrument, one point by reflection and the other by direct vision. If the two stations cannot both be seen, the operator moves to the right or left until this is the case, and the staves at A and B are both superimposed on the cross-line of the mirror. In this way any number of points in the curve can be fixed as the observer moves from A and B, and on arriving at this part the tangent is also obtained, and a ranging rod can be set up at any convenient distance to mark this. To find the length of the arc from A to B, it is only necessary to multiply the radius by a number engraved on the back of the instrument where the slanting edge of the body cuts a scale-marked arc. Fig. 4 shows all the elements of a curve that can be obtained either by direct reading from the scales of the instrument or by simple arithmetical calculation. These are:

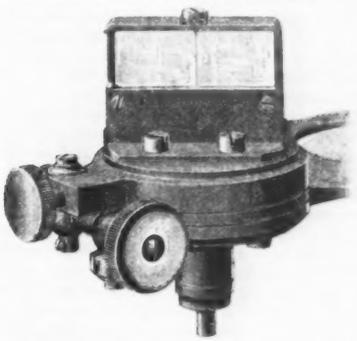
Radius $A O = 1$		
Chord $A B$ read direct on scale		
Arc $A F B$	"	"
Versin $F H$	"	"
Angle $A C B$	"	" left to right
" $E A B$	"	" "
" $A O B$	"	" right to left
" $G A B = \frac{1}{2} A O B$		
" $A G B = 180 - A O B$		
" $O A B = E A B - 90$		

$$\text{Distance } G F = \frac{A H^2}{H O} - F H$$

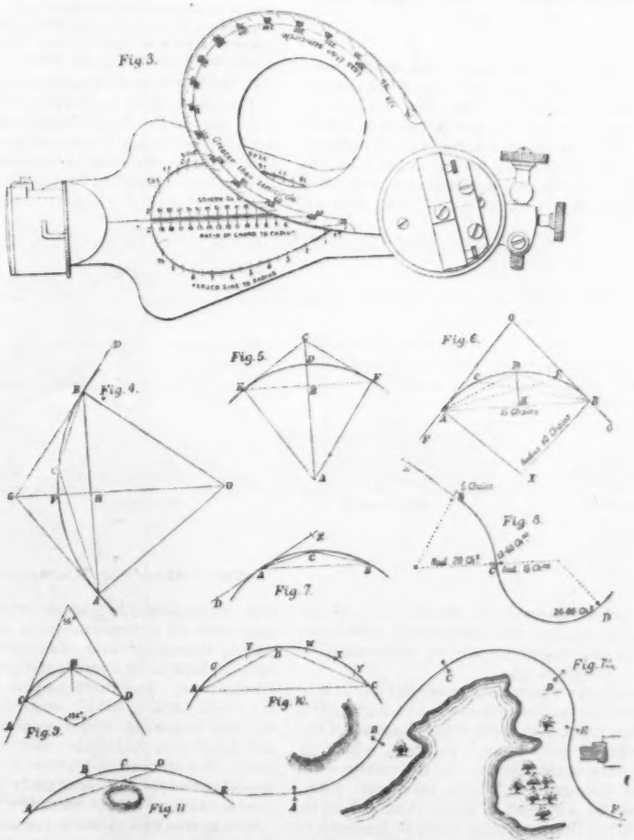
Again, in Fig. 5, to find the distance from the intersection of the tangents to the middle point of the curve, take the square of E B (half the chord E F), and divide it by A B (the radius minus the versed sine). This gives the distance C B, from which the versed sine may be abstracted to give the distance C D required. Or,

$$\frac{B E^2}{B A} - B D = C D$$

Suppose that a line composed of arcs and straight lines is required, such as A B C D E, Fig. 8, and with the length shown range a tangent from A and measure 5 chains in the direction of B. Let B C = 8.6 chains, then set the instrument to ratio of arc to radius of $\frac{8.6}{20} = .43$, and with this range curve C C. Then at C, set the instrument to ratio of $\frac{11.20}{15} = .743$, the numerator being length of arc C D, and range the curve C D, and from D the tangent can be obtained as previously described.



As another case, Fig. 9, suppose the angle between the tangents and the middle point of the curve given. Then subtract the angle from 180, and the difference = the angle at center of curve. Thus suppose the given angle is 56, then angle at center = 124°. Take half this = 62°, and set the instru-



Applications of the Trotter Curve Ranger.

Suppose it is required to set out a tanget to any given arc. Let A, Fig. 7, be this point. Then set up rods at C and B, any two other points in the curve, and take a position at C, and adjust the instrument till A and B are superimposed on the cross-line of the mirror. Then moving back to A, observe B by direct vision and set up a rod at D in the line of sight by reflection. Then D A is the tangent required.

ment at this point of the graduated edge using the upper row of figures. Then walk along the tangent till a rod A set up somewhere in the tangent is seen by reflection superimposed with the point B on the

ment then marks the point *C* where the tangent meets the curve. Then proceeding with the instrument to *B* set the limb at 124° and sight *C* by reflection. Where the line of direct vision cuts the other tangent is then the point of contact with the curve, which can be ranged as previously described.

If three points of the curve are given, as in Fig. 10, and all are accessible, set up rods at *A* and *C*, and at *B* place both on the cross-line, and then range the curve with the angle so obtained. If, however, as in Fig. 11, an obstacle intervenes between *A* and *E*, it will not be possible to set out in this way more of the curve than the arc *B C D*. When, however, the points B and *D* are obtained the rest can be set out by taking a new angle at *B* as, e. g., the angle *A B D*, and completing the arc between *B A* with this.

As a final case, suppose no data whatever are given, as in the surveys for a colonial railway, where no previous surveys are in existence. Let Fig. 12 represent such a case, and suppose the surveyor has arrived at the point *A*, and there finds obstacles which render a deflection of the line necessary. All he must do in such a case is to select a number of points *B C D E F*, which will carry his line clear of the obstacles, and then these curves can be filled in with the instrument and be either fully marked out, or their tangent points alone fixed on the ground, in which case the radii and lengths of the arcs would be recorded after reference to the instrument. It should be observed that, though the instrument is not intended to replace the theodolite in very accurate surveying, it nevertheless has one very great advantage over the older instrument, in that errors made by it are not cumulative, and no assistants, chain, or tables are required as in the case when curves are set out by the method of tangential angles with the theodolite.

The "Cow-Catcher" and John Bull Locomotive.

The accompanying illustration shows the locomotive "John Bull," built by Robert Stephenson & Co. at Newcastle-on-Tyne, for the Camden & Amboy Transportation Co., and shipped to Philadelphia in 1831. As shipped it was a quite different looking engine from that which appears in the cut, the latter showing its appearance as exhibited t the Philadelphia Centennial in 1876. Not (rl despite GEORGE STEPHENSON'S opinion that it would be "bad for the coo" to encounter one, it was seen that it would be bad for the engine too, if an unsupported wedge of the present form were attached to the engine frame only, and accordingly the first "cow-catchers" were of the now forgotten form illustrated.

Mr. DAVID STEVENSON, C. E., in his "Civil Engineering of North America," (published by John Weale 1838), describes this device more in detail as follows:

To obviate this [danger from cattle] and render railway traveling more safe, an apparatus called a "guard" has been generally introduced, a drawing of which is given in Plate XI. The guard consists of a strong framework of wood, fixed to the fore axle of the locomotive carriage, and supported on two small wheels about 2 feet in diameter, which run on the rails about 3 feet in advance of the engine. The outer extremity of the framework is shod with iron slightly bent up, and comes to within an inch of the top of the rails. The upper part of the surface of the guard is covered with a wood, and the lower part with an iron grating. The apparatus affords a complete protection to the wheels of the engine.

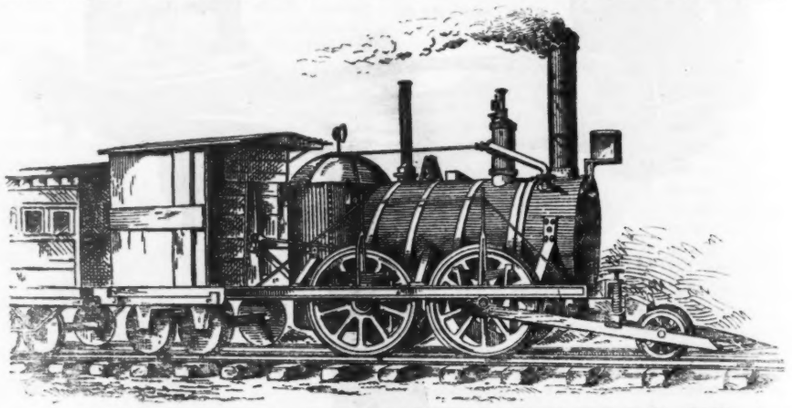
In Mr. SETVENSON'S drawing the device projects 11 ft. 6 ins. beyond the front axle of the locomotive, 7 ft. 6 ins. beyond the front of the locomotive, and 4 ft. 6 ins. beyond the small supporting wheels. In our cut the projection seems to be somewhat less than this.

After this engine had been landed at Philadelphia in 1831, it was carried in a sloop to Bordentown, N. J., and, being packed in wagons, was hauled out to the only piece of permanent track of the Camden & Amboy Company then completed, a line about ¾ mile in length, and situated about one mile from Bordentown. The machinery was put together on the track, and a tender was constructed from a whiskey hogshead placed on a small platform car which had been used by the contractor in building the road. The connection between the pump of the locomotive and the tank was made by means of leather hose fitted up by a Bordentown shoemaker.

Steam was first raised in the boiler Sept. 15, 1831, and after several trial trips the first public exhibition took place Nov. 12. R. L. STEVENS acted as conductor and general director, and the entire New Jersey Legislature were present as witnesses. The "John Bull" remained in Bordentown until 1833 and was occasionally used elsewhere until as late as 1866. The cylinders are 9x20 ins. and the driving wheels 4x6 ins. in diameter, with hubs of cast and tires of wrought iron. The entire weight of the locomotive is 10 tons.

With the old machine there was exhibited a portion of the original track above mentioned. The rails were rolled in England, and were supported on stone blocks, wooden ties not being deemed safe.

It will thus be seen that the test of his engine took place 2 mos. 28 days after the first American passenger train was hauled by the "De Witt Clinton" on the Mohawk & Hudson R. R. (Aug. 9, 1831), 35 days after the first English locomotive was tested on the Mohawk & Hudson (Sept. 16, 1831) and 9 mos. 28 days after the first American locomotive, the "Best Friend" was tested on the South Carolina Railroad (Jan. 15, 1831). Nevertheless it was one of the very earliest; and that it should have continued to do actual work at times up to 1866 reflects great honor on its builders.

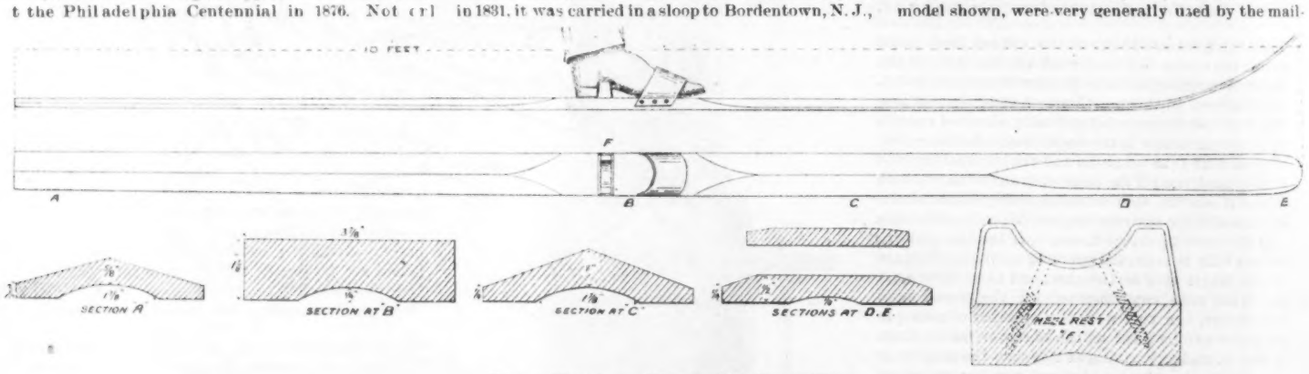


The Locomotive "John Bull," built by Robert Stephenson & Co., 1831.

The Norwegian Skee, or Snow-Shoe.

For the original working drawing of a *skee* or Norwegian snow-shoe, here presented, we are indebted to Mr. E. P. NORTH, M. Am. Soc. C. E. Mr. NORTH obtained it from Mr. JOHN R. GILLIS, a deceased member of the Am. Soc. C. E. and engineer of tunnels 1 and 2 on the Union Pacific Railroad.

Snow-shoes of this description, and made on the model shown, were very generally used by the mail-carriers in the mountain regions of California and Nevada, before the advent of the railways, and also to a considerable extent by the engineers during the construction of the Central Pacific Railroad. Over undulating country, several of the mail-carriers are credited with having made as much as eighty miles per day on these shoes, although this was a very unusual record.



The "Skee" or Norwegien Snow-Shoe.

The *skee* is very simple in its design and construction. The material used in the West was so-called black pine, for which the nearest substitute in the Eastern States is spruce and tamarack or hackmatack. The drawing explains itself as to dimensions. The groove in the under part is to facilitate steering and to enable the runner to travel along a side-hill.

In use it differs widely from the more familiar Canadian snow-shoe, which is a light frame of bent wood, interlaced with thongs of raw hide, hard twisted twine, or deer sinews. The Canadian shoe,

permitting the soft snow to pass through the meshes, must be lifted by the toe to a considerable height with each step, and the shoe dragged along on the snow as the leg is advanced; hence a moccasin is an essential adjunct to the Canadian type. The *skee* on the other hand, is slid over the snow, by means of the strap shown resting against the instep, and is never lifted from the snow except when a jump is to be made. As each shoe presents a bearing surface of over three square feet and is without openings for the snow to pass through, it is claimed that the Norwegian type is preferable to the Canadian for use in soft snow.

On account of its great length, ten feet, the *skee* is best adapted to use in comparatively smooth and undulating country, or through open woods. It is in going down hill that the greatest speed is attained, and a stout steering or brake pole is very necessary at such times to guide the line of travel and to check undue velocity. The drawing is presented as a curiosity in the line of "rapid transit;" but the editors of this journal especially disclaim any liability for mishaps accompanying a first practical test of the possibilities of this Norwegian invention.

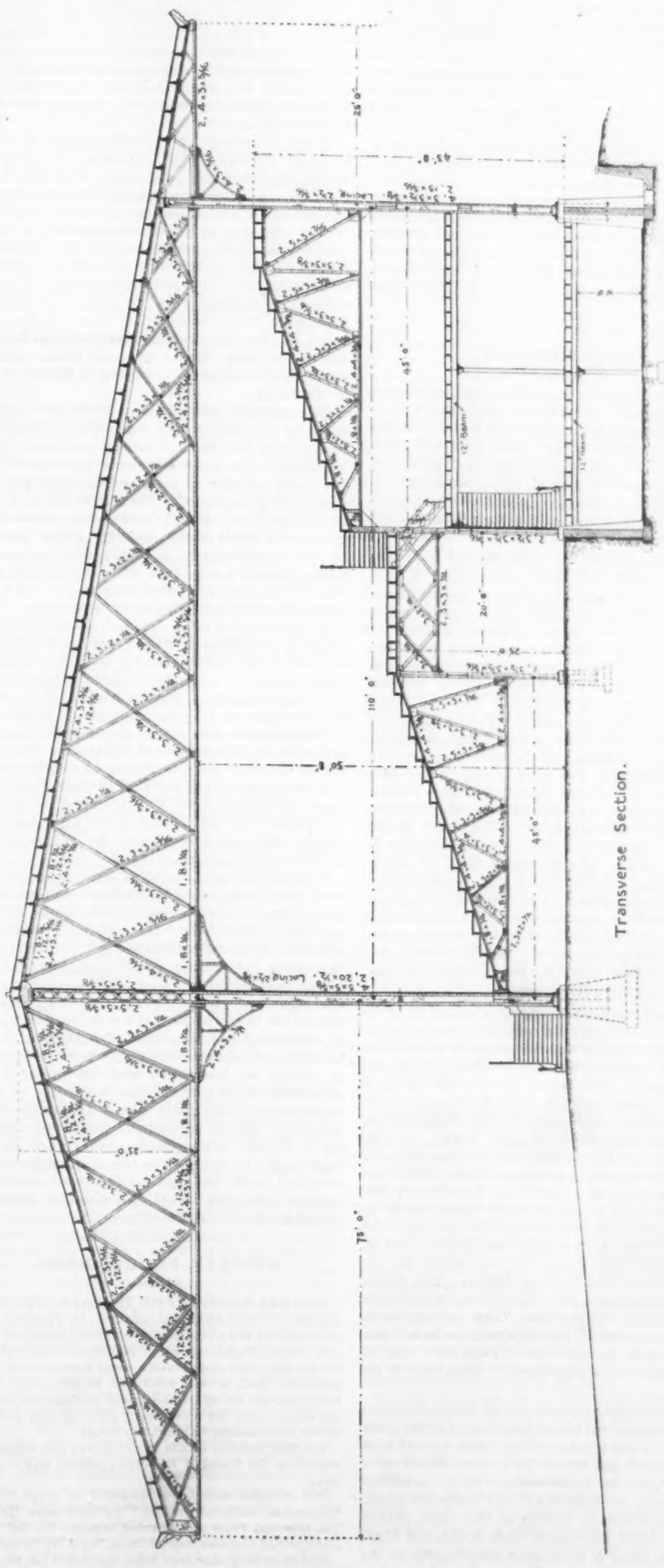
The Grand Stand of the Monmouth Park Association.

The sectional view of the grand stand of the Monmouth Park Association, here shown, is especially interesting on account of its construction and from the fact that it eclipses in size, we believe, any stand of its type in the country. The total length of the structure is 700 ft. with an extreme width of 210 ft., and it will accommodate 10,000 people, seated. The cantilever, owing to its overhang of 75 ft., is rather novel in roof contruction.

The front posts, located 50 ft. apart, are built up of angles and plates, and are proportioned to carry a load of 160 tons. Both the roof trusses and the girders carrying the seats are spaced 25 ft. apart and they have several systems of longitudinal bracing. The sections of the chief members are fully given on the elevation presented.

As here shown, a dining-room, 300×45 ft., is provided for in an intermediate story, and under it is a kitchen 200×45 ft. With the exception of the purlins and floor-joist, the entire structure is built of iron, and the total weight of iron is very nearly 1,000 tons.

The contract was awarded to the Wallis Iron Works, of Jersey City, N. J., in open competition and it will be completed by March 1, 1890. The structure was designed by Mr. F. S. WILLIAMSON, the engineer of the Wallis Works, from suggestions made by Mr. D. D. WITHERS, the Treasurer of the Association. It reflects much credit upon these parties for its completeness, size, and adaptability to the purpose intended, as well as in the qualities of durability.



Section of the Grand Stand of the Monmouth Park Association. The Wallis Iron Works; F. S. WILLIAMSON, *Engineer.*

ASPHALT PAVEMENT AND ILLUMINATING GAS.—City Engineer DEHNHARDT, of Frankfort, Germany, has been troubled by the asphalt pavement on some streets in that city becoming friable and porous. He attributed this to the escape of illuminating gas, but this view of the case was ridiculed by several German authorities on this material. Recently these pavements were torn up and it was found tha the gas pipes had several leaks under the worst parts of the street. Even then, the "authorities" did not admit that the material could be injured by gas. To settle the matter, Herr DEHNHARDT sent pieces of sound and injured pavement to a noted chemist, who placed the sound fragments in a tube through which gas was flowing. After a week it was found that the samples were reduced to the same brittle condition in which parts of the pavement had been, thus proving conclusively that asphalt must be protected from illuminating gas.

THE LOS ANGELES SEWERAGE Board of Engineers, including Mr. R. HERING, Chairman, Mr. J. E. JACKSON, and City Engineer EATON, have made their report to the City Councils. After fully discussing the situation and the needs of a prospective population of 200,000, the board recommends the construction of an outfall sewer at Ballona, carried, 3,000 ft. into the ocean and discharging in

25 ft. of water at low tide. The sale of sewage water during the irrigation season is also recommended. The report considers the sewerage and the storm-water drains separately owing to cost of providing for both in one outfall. The interior system of sewers is provided with several large intercepting sewers, these and the main sewers will have a length of 84,440 ft. and their estimated cost is $374,000. The storm-drain system is estimated to cost $512.000 the Ballona outfall project is estimated to cost $696,775. Land purification, including the purchase of 800 acres of sandy land, would cost, according to location, from $735,400 to $856,000. The cost of chemical precipitation, with a yearly expense of $29,172, would be for works and outfall, $491,900 near the river, or $542,800 at Ballona, and $681,000 if two sets of works were used. The report was referred to the Committee of the Whole, to be printed and discussed.

BOOK REVIEWS.

The Spires and Towers of England, by CHARLES WICKS, Architect, Boston. Ticknor & Co. Large 4to. $15.

Messrs. Ticknor & Co. have been issuing in the *American Architect* a few plates from this work at intervals through a period of two years, and welcome as these occasional plates have been to lovers of Gothic architecture, the present complete reprint will be received with even greater delight and satisfaction.

It has happened, in the most natural way, that in America, Gothic work has received many a blow from involuntary traducers,—men who would have been, and would be still if they could, the worthy followers of the skilful and inspired builders of the Middle Ages. This comes chiefly from the fact that in a young country, men are necessarily forced into professional practice with less training to back them than is the case in Europe. There is little or no tradition among us, and a dearth of architectural inspiration, which latter is caused by the non-existence of historic monuments throughout the land, and usually results in a perceptible want of life and vigor in whatever is done in the way of art. We cannot, in America, breathe an atmosphere of art, because we have just begun to learn that we know nothing of it, comparatively speaking; and the men who have tried to revive Gothic architecture have found that, not only were the public unappreciative, but that they themselves were lacking in a certain something, which only certain conditions could supply. Then, again, Americans are prone to go hastily in all they do, and to finish in a year that which really requires ten or twenty to properly execute.

The want of sound training in any school of art is sure to lead to sad results, and this applies with special force to Gothic architecture, in which it is particularly necessary that a practitioner should be well grounded. The detail follows set precept, since the style has been very fully developed, and is usually intricate. The perfection of proportions is the distinguishing mark of good work. In the Romanesque and Classic revivals, there is room for considerable originality and improvement when we apply them to present needs and conditions; but Gothic work must be handled with extreme care by the free-thinker. Indeed, we feel like saying to the man of innovations what RICHARDSON once said to HUBERT HERKOMER, in an anecdote which, we believe, has never been in print before. The latter was in raptures over a plan of his own for his house at Bushey Park, near London. "I am going to have a dream of a house!" he exclaimed, as he sat discussing it with RICHARDSON. "Take care that it does not turn out a nightmare," RICHARDSON replied.

We unfortunately possess a good many architectural nightmares, but the publication of every good book on art is and must continue to be a great help to all who can get access to it, and therefore a powerful agent for improvement in our architecture. In fact, the majority of our designers must, if they would ever be worthy of the name, gather the bulk of their knowledge from books, and illustrated ones too. A book may contain ever so instructive reading, but the addition of good illustrations adds more to its efficiency as an educator than the layman can appreciate.

There is one fault we can find with this book, and that is, that it does not go farther and cover more ground still; but this is not to be laid at the door of Messrs. Ticknor & Co. The spires which CHARLES WICKES drew are among the best of those of the smaller English churches, and their applicability to modern conditions makes the illustrations valuable references to every architect of Gothic churches.

Of the excellence of the reproduction it is unnecessary to speak. The publishers have an established reputation for good work. The plates are outlined, as concerns the architectural work proper, while the trees and accessories are more fully indicated. All this, in a color approaching a sepia, produces an exquisitely delicate effect. There is a freedom from the "woolly" look which reproductions often have; and although we have never examined the original work, we should say this reprint must closely approach, if indeed it does not equal, it. The three volumes are bound in one, a far preferable form. Every architect learns soon to appreciate the value of concentrated matter in reference books

The originally contemplated work was done in color by the author, but the outline edition was produced by the advice of certain architects whom he consulted, an act which made it accessible to an increased number of men, and consequently productive of greater good. The necessarily high price of architectural books, in many cases, places them beyond the reach of the majority, in the libraries of the wealthier men, or in the dim alcoves of a public library, where they often rot in oblivion. That WICKES did not print altogether in color was indeed a great boon to latter-day architects.

It is manifest to all students of architecture that this is an age of Greek, Roman, and Eastern revival rather than of Gothic; but for that very reason the reappearance of a standard Gothic work is a cause for congratulation. The dangers which American architecture runs from the rudeness of badly handled Romanesque and classic detail and proportion are patent to all observers of the times. The eccentricity which is born of mixed nationalities runs riot over much of the building of the day: and good books on Gothic work, if they cannot bring about the Gothic revival so striven for a few years ago, can at least speak eloquently for refinement and careful study in the other styles.

It would be an interesting study, in connection with turning the pages of this book on famous English spires, to review carefully the causes, political and social, which led to the building of the abbey churches, the great cathedrals, and in brief the development of Gothic architecture, for from the larger buildings the smaller ones necessarily grew; that is, to trace from the vigorous and crude outlines of the Romanesque builders the gradual growth of the earlier and more studied Gothic up to its highest point of excellence, thence to its debasement. It would be instructive and interesting in this connection to do this, because every line of those spires would mean more than it does to the casual reviewer. Space prevents us from even attempting to do this, but we must congratulate Messrs. Ticknor & Co., not only on this reproduction of an excellent work, but also on the stand they have taken as educators in art in a direction which is bound to produce good results.

SOCIETY PROCEEDINGS.

American Society of Civil Engineers.—The annual meeting of the Society was held Jan. 15; President MAX J. BECKER in the chair, and a number of members present. The new addition to the Society's house was used for the first time and proved a great convenience. It is expected that it will meet the requirements of the meetings, and afford the necessary accommodations for the library, etc., for a few years, until the new building, which it is intended to build, is erected.

The first business of the meeting was the reading of reports of the Board of Direction, Officers and Committees.

The Norman medal was awarded to paper No. 418, "American Railroad Bridges," by THEODORE COOPER. The Rowland Prize was awarded to paper No 398, "Construction of the Sweetwater Dam," by J. D. SCHUYLER.

The following members were appointed on the committee for Tests of Material for Metallic Structures, W. H. BURR, J. G. DAGRON, H. B. SEAMAN, R. W. HUNT, RCIVAL BERTS, G. BOUSCAREN and Mr. MORSE

The Committee on Rail Sections as appointed was practically the same as the former committee of seven on the Relations to each other of Railway Wheels and Rails, with the addition of Messrs. J. D. HAWKS, DON J. WHITTEMORE, G. BOUSCAREN and S. WHINERY. Mr. WHITTEMORE, however, objected to the appointment of such a committee, on the ground that it was not the office of the Society to make designs, or to say how matter should be disposed in certain forms. While he recognized the advantages of a standard section, he preferred to leave it to railway managers and the engineers of rolling mills. He considered that the work of such committees as this and as the one on the Causes of the South Fork Dam Disaster was beyond the purpose of the Society.

The committee on the South Fork Dam reported progress, stating that in view of pending suits against the owners of the dam, it was not deemed expedient at this time to publish the full report. This full report will be signed and sealed and entrusted to the chairman of the committee until such time as it may seem proper to publish it. Mr. SANDFORD FLEMING, President of the Committee on Standard Time, presented the committe's report; and Mr. F. BROOKS, member of the committee, read a brief paper as to changes in standard coinage. The preliminary report of the Committee on the Revision of the Constitution, which has been already published, was read.

The following officers were elected for the current year:

President, W. P. SHINN.
Vice-Presidents, A. FTELEY, MENDEZ COHEN.
Secretary, JOHN BOGART.
Treasurer, GEO. S. GREENE.
Directors; C. B. BRUSH, ROBT. VAN BUREN, WM. LUDLOW, THEODORE VOORHEES and WM. J. CURTIS.

At the afternoon session, the report of the Committee on Standard Time was discussed and adopted, and the Board of Direction requested to have the memorial to Congress, suggested by the committee, presented in due course. A good deal of discussion arose on the propriety of authorizing action of any kind before Congress without a letter ballot, and a ballot was finally ordered.

The Committee on Impurities of Domestic Water Supply made a brief report, suggesting the establishment of a special and complete library of the literature relating to water supply, together with the collating and cataloguing of all published information. In the discussion it was suggested by Mr. BRUSH and Mr. FTELEY that circulars should be sent to Water Commissioners, Health Boards, etc., making inquiries in regard to this question, and also in regard to the practicability of forming a national bureau of information on water supply by such Commissioners, Boards, etc. It was considered that the work of the committee should include the whole country, and not the Atlantic States only as originally intended. Dr. EGGLESTON presented a resolution for the appointment of a Committee on Units and Measures.

Mr. WHITTEMORE, then presented a resolution for the rescinding of the action of the Society in appointing a Committee on Rail Sections, and this led to considerable discussion and a good deal of confusion as to parliamentary procedure in such cases. The ultimate result was that the question of reconsidering this action and discharging the new committee will now be submitted to letter ballot of the whole Society.

During the meeting, a set of andirons and fire-place fittings for the fire-place in the new extension were presented to the Society by the American Institute of Electrical Engineers, which has for some time held its meetings in the Society house.

In the evening, a paper on the sinking of the caisson for the piers of the Hawkesbury Bridge (Australia) was read by Mr. CHARLES MACDONALD, and was illustrated by a number of stereopticon views. A supper and reception followed the reading of this paper.

The following new members were declared elected:

MEMBERS.

ROBERT LINAH COBB, Chf. Eng. Const., L. & N. R. L.

BENJAMIN DOUGLAS, Eng. of Bridges, Michigan Central R. R.

GEO. MCGREW FARLEY, Supt. W. Div., N. Y. & N. E. R. R.

A. E. B. FEIND, Drainage & Water Supply Comm, Chicago.

LOUIS FREDERICK FIESER, Eng. M. of Way, C. C. C. & St. L. R. R.

JAMES K. GEDDES, Chf. Eng., B., Z. & C. Ry., Zanesville O.

WM. T. GOULD, Asst. Eng., Mobile & Ohio R. R., St. Louis.

HENRY R. HOLBROOK, Chf. Eng., Pueblo & State Line R. R., Pueblo, Col.

L. S. RANDOLPH, Mast. of Mail., Cumb. & Penn. R. R., Mt. Savage, Ind.

M. H. ROGERS, Div. Eng. D. & R. G. R. R., Pueblo, Col.

ROBERT D. ROW, Eng. of Bridges & Buildings, New Mex Div., A. T. & S. F. R. R., Las Vegas, N. M.

JOHN H. WALLACE, Asst. Supt. of Track, So. Pac. Ry., San Francisco.

HENRY F. WHITE, Chf. Eng., B. C. R. & N. Ry. Cedar Rapids, Ia.

HERBERT M. WILSON, U. S. Geol. Survey, (Montana). Washington, D. C.

JUNIORS.

M. L. BYERS, Asst. Eng. M. of Way, P. R. R., New Castle, Pa.

J. F. HEALY, Res. Eng., Cin. Ala. & Atlantic Ry., Fayetteville, Tenn.

R. P. MILLER, Asst. Eng., Richmond & Danville R. R., Richmond, Va.

On Jan. 16, an excursion was made to the Government Works at Willett's Point, N. Y., and the Brooklyn navy yard. In the evening a reception was held at the Engineers' Club, being tendered the Society by the Club.

The following is an abstract of the report of the Board of Direction:

On Jan. 1, 1890, the membership is as follows:

	Resident.	Non-resident.	
Honorary Members	5	3	
Corresponding Members	0	3	
Members	180	830	
Associates	16	39	
Juniors	39	130	
	240	1,005;	
Total resident and non-resident			1,245
Fellows, 56, of whom 5 members are included above, leaving			51
			1,206
Subscribers to the Building Fund, 140, of whom 85 are entered in one or other of the above classes 16; deceased, leaving			39
Total connected with the Society, Jan 1, 1890			1,355

The additions during the past year to the several classes of Society Membership have been:

Members qualified	84
Associates "	11
Juniors "	32
Fellow "	1
Total additions	128

The decrease during the past year in the several classes of membership has been:

Honorary Members	died, 2	resigned, 0;	total 2
Members	" 13	" 5	" 18
Associates	" 1	" 3	" 4
Juniors	" 0	" 1	tr to M 6; 7
Fellows	" 4		4
Subscriber	" 1		1

Totals; Deaths, 21; resignations, 9; transf'd, 0; total 36

There has been an addition of 128 to the various classes of membership, and a decrease of 36, making the actual net additions during the year, 92 in number. On Jan. 1, 1889, there were 25 proposals pending; 187 proposals have been received during the year; 84 candidates have been elected Members, of whom 6 were transferred from Juniors; 10 candidates have been elected as Associates; 35 candidates have been elected as Juniors; 1 candidate has been elected a Fellow. There are 54 proposals now pending.

The library has been increased during the year by the following additions:

Books and Pamphlets	468
Maps, Plans, Drawings, Charts, Photographs and Engravings	221

The Society has lost, by death, during the term covered by this report; 2 Honorary Members, HORATIO ALLEN and JOHN ERICSSON; 13 Members, ADNA ANDERSON, WM. S. BARBOUR, HENRY A. BENTLEY, HENRY D. BLUNDEN, HENRY S. CRAVEN, N. W. ELLIS, LOUIS LESAGE, CHAS. A. MARSHALL, JAMES H. MORLEY, E. S. PHILBRICK, ALBERT B. ROGERS, CHARLES C. SMITH, and W. H. WIGHTMAN; Associate, EDWARD BAUMANN; and 4 FELLOWS; E. P. ALLIS, S. M. FELTON, WM. H. LYON, and WM. THAW.

Twenty-one meetings of the Society were held, including the annual meeting, in New York, and the Annual Convention, at Seabright, N. J. On Feb. 20, a joint meeting of the Society and the American Institute of Mining Engineers was held, at which occurred a discussion on "Iron and Steel." Twelve meetings of the Board of Direction have been held.

The Annual Convention was held at Seabright, N. J; 134 members present, and a number of ladies and visiting engineers. At the business meeting the reports of the special committees on The Proper Relation to each Other of the Sections of Railway Wheels and Rails, and on Standard Time, were presented, and the subjects considered. Propositions for the appointment of other committees were discussed and afterwards submitted to letter ballot of the whole membership, resulting in the passage of resolutions appointing a committee on Standard Sections of Railway Rails, on Impurities of Domestic Water Supply, and on Uniform Methods of Testing Materials used in Metallic Structures and on such requirements of these materials as may conduce to further improve the grade of such structures. A resolution was also adopted for the appointment of a committee of seven members of the Society to consider and report upon a Systematic Revision of the Constitution and By-Laws.

The building of the extension to the Society House was determined upon after very careful consideration by the Board of Direction, to which the decision as to the best present expenditure of a portion of the building fund was referred. It is not intended that this extension should be considered as a culmination of the movement for securing a suitable permanent home for the Society, but it is believed that it will accommodate the uses of the Society for a few years, during which the effort to secure the means to build a house may be continued.

A number of members visited Europe during the past summer. Their reception by the foreign engineers was of the most hospitable and cordial character. The Board, in behalf of the Society, takes pleasure in putting upon permanent record an expression of the appreciation by American engineers of the fraternal professional feeling thus exhibited by our foreign brothers.

During the year a most valuable addition has been made to the literature of the Society. An index to the Transactions from their beginning to the present time has been completed by the Secretary and will directly be issued. The work is thorough and exhaustive. While it has required a considerable outlay of time and money, it has been felt for some time to be an absolute necessity.

The following is a summary of the the report of the Treasurer:

Balance on hand, Dec. 31 1888.		$6,515.02
Receipts:		
Entrance fees	$ 3,230.00	
Dues	19,958.00	
Miscellaneous	10,096.89	33,284.89
Total		$39,799 91
Disbursements		$28,875 46
Balance on hand, Dec. 31, 1889		10,924.45
Total		$39,799.91

Engineers' Club of St. Louis.— At the meeting on Jan. 8, President NIPHER in the chair, 26 members and 5 visitors present, the Executive Committee submitted the following programme of meetings and papers for the year 1890.

Jan. 8, 1890.— Method of Definite Location of Gauge Line on Car Wheels, B. F. CROW; Deflection of Framed Structures, J. B. JOHNSON.

Jan. 22.—Fuel Gas, WM. B. POTTER.

Feb. 5.—Tests of Water-Works Engines, GEO. W. DUDLEY; Spiral Springs, NATHAN W. PERKINS, Jr.

Feb. 19.—The Pemberton Concentrater, FRANK NICHOLSON; The Substructure of Cairo Bridge, EDWARD H. CONNOR.

March 5.—Elevated Railroads, GEO. H. PEGRAM.

March 19.—The Smoke Problem, WM. B. POTTER.

April 2.—A National Federation of Engineering Societies, J. B. JOHNSON.

April 16.—Railway Inclines, ISAAC A. SMITH; The Reproduction of Drawings, DAVID C. HUMPHREY.

May 7.—Compound Locomotives, ARTHUR T. WOODS; Granitoid Curb and Gutter, OTTO SCHMITZ.

May 21.—River Pollution in the United States, CHAS. C. BROWN.

June 4.—Report of Committee on Collection of Local Data, S. B. RUSSELL, Chairman.

Sept. 17.—The Telescope; Its Optical Qualities and Application to Measurements, O. L. PETITDIDIER.

Oct. 1.—History of a Few Railway Culverts, CHAS. I. BROWN.

Oct. 15.—Pumping Machinery, JAMES M. SHERMAN.

Nov. 5.—The Graphical Representation of the Output of the Steam Engine, F. E. NIPHER.

Nov. 19.—Selection of Committee on Nomination of Officers; Stripping Coal, LEWIS STOCKETT.

Dec. 3.—Annual Meeting.— Nominations of officers for the year 1891; annual reports of officers and committees.

Dec. 17.—Announcement of results of election of officers; address of retiring president.

Mr. B. F. CROW read a paper on "Method of Definite Location of Gauge Line on Car Wheels." He discussed the matter principally with reference to street railway practice, showing the lack of uniformity and the difficulty of determining definitely the gauge of any street railway or pair of wheels. He explained a simple method for settling the matter, and illustrated it with blackboard sketches. Mr. CROW exhibited a number of patterns of various forms of street rail and wheel. He recommended the proposed method for general adoption.

Prof. J. B. JOHNSON then read a paper on "Deflection of Framed Structures," to which he had added a discussion of the distribution of stresses over redundant members. The Professor's discussion was general in its application, and presented a method for determining the stresses in those forms of truss which had been usually considered indeterminate, and consequently to be avoided. The method of using the formula was fully explained, and illustrated by an example from a Pratt truss. Mr. PEGRAM called attention to the importance of this question, as it was usually given far too little study by engineers. He explained a simple method, which he had used in determining the camber of a bridge. He also called attention to the fact that the load was increasing at the rate of ½ per cent. per month.

WM. H. BRYAN, *Secretary.*

Engineers' Club of Cincinnati.—The second annual meeting was held Dec. 19; 29 members present. Two applications for membership were received and four new members elected, making a total membership of 90 at that date.

The following officers were elected to serve during the ensuing year: President, G. B. NICHOLSON; Vice-President, R. L. READ, Directors, K. E. HILGARD, L. W. MATHEWSON and WARD BALDWIN; Secretary and Treasurer, J. F. WILSON. The retiring President read an interesting address on the progress of engineering during the past year.

Illinois Society of Civil Engineers and Surveyors.—The fifth annual meeting will be held in the City Hall at Peoria, Ill., commencing Jan. 29, and continuing Jan. 30 and 31.

The following papers have been promised, and others are under consideration:

"President's Address," C. G. ELLIOTT, Gilman. "House Drainage," S. A. BULLARD, Springfield. "Strip Coal Mining," J. O. WRIGH, LaFayette, Ind. "Prevention of the Abrasion of River and Creek Banks," E. J. CHAMBERLAIN, Pittsfield. "Peoria's New Water-Works," W. C. HAWLEY, Peoria. "Engineering Features of the Operating Department of Railways," E. L. MORSE, Cazenovia. "Sharp Curves," EDWIN A. HILL, Cincinnati, O. "Masonry Structures for Railways," T. A. ALLEN, Terre Haute, Ind. "A Change of Line on the C. & A. R. R.," E. PHILBRICK, Chicago. "Interlocking Switches and Signals," CHARLES HANSEL, Springfield. "The Distribution Systems for Water-Works," D. W. MEAD, Rockford. 'How to Find a True Meridian," D. H. DAVISON, Minonk. "Iron Substructure for Highway Bridges," J. H. BURNHAM, Bloomington. "Topographical Surveying for Drainage Purposes," D. J. STANFORD, Chatsworth. "Drainage," RUDOLPH BOURLAND, Peoria. "Alterations in the Washington Street Tunnel," S. C. COLTON, Chicago. "The Elimination of Local Attraction in Mine Surveying," D. H. DAVISON, Minonk. "The Mounds Yard," S. F. BALCOM, Champaign. "Notes on the Use of Cement Mortar," Prof. I. O. BAKER.

The topical discussions which formed such an interesting part of the last programme will be continued. The topics take the place of short papers upon matters on which the opinion, experience or custom of members may be briefly given. The committee on exhibit of drawings promises a full display.

A. N. TALBOT, *Executive Committee,*
Champaign, Ill.

New England Water-Works Association.—An adjourned meeting was held at Young's Hotel, Boston, Jan. 8.

After lunch addresses were made on miscellaneous subjects pertaining to the management of city water works, and were discussed by different gentlemen, Supt. EDWARD DARLING of Pawtucket, R. I.; Supt. DEXTER BRACKETT, of the Boston Water-Works; Ex-Supt. E. S. JONES, of the Boston Water-Works; W. H. RICHARDS, F. L. FULLER, M. M. TIDD, E. H. GOWING, Supt. KIMBALL, of Somerville, and Supt. HAWES, of Fall River.

The following new members were elected: L. M. BANCROFT, Commissioner, Reading; WALTER HALE, C. E., Westfield, Conn.; A. F. SALMON, Commissioner, Lowell; F. P. WEBSTER, Superintendent, Laconia, N. H.; PHILIP J. DOHERTY, Commissioner, Boston; CHARLES E. DRAKE, C. E., New Bedford; Z. R. FORBES, Assistant Superintendent, Brookline.

New England Railroad Club.— At the meeting on Jan. 8 "Notes on Foreign Travel" were presented by several members of the club and others. Mr. ANDREW J. PITKIN, Superintendent of the Schenectady Locomotive Works, said he was agreeably surprised by the comfort of travel in Great Britain after the discomfort of an all day journey on the continent. He commended the English system of passenger car construction in that the dead load per passenger was not more than one-fourth to one-third what is common in America. The doors being at the sides, local and suburban trains can run with stops as short as 30 seconds to 1 minute. The principal difference in locomotive practice is in the use of compounds. The most frequent complaint against compounds arise from placing too little weight on the drivers. Workmanship on locomotives is laboriously perfect, and much time is spent in finishing and polishing parts that had better be painted.

Mr. JOHN COGHLAN, Master Car Builder of the Boston, Revere Beach & Lynn Railroad, and Mr. J. A. COLEMAN of Providence, R. I., gave brief notes of their respective experience abroad.

Mr. FIRTH spoke of the railways of Russia. That country, he said, was fortunate in having its first railways built by American engineers upon American models. Rolling stock there is now very mixed, some cars being built on French and English models and some following the American types in many respects. Russia has established excellent schools of technology and is educating its young men in the construction of railways and rolling stock.

Remarks were also made by Mr. MCFETHRIES and by Mr. GEO. COLEMAN.

ENGINEERING NEWS

AND

AMERICAN RAILWAY JOURNAL.

Published Weekly at Tribune Building, New York.

VOL. XXIII. Saturday, Jan. 18, 1890.

D. McN. STAUFFER A. M. WELLINGTON

EDITORS.

CHAS. W. BAKER E. E. R. TRATMAN M. N. BAKER

ASSOCIATE EDITORS,

GEO. H. FROST . . . . . BUSINESS MANAGER

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Drawings and Photographs *of all new engineering works or designs, large or small, of interest from their magnitude, novelty, or originality, as well as newly adopted* **Standard Plans** *for engineering structures or details, rolling stock, etc., are always desired for early publication. Also* **Brief Technical Notes** *of the cost or manner of executing work, tests of materials, machines or other new devices, and* **News of New Construction** *of all kinds.* **Letters** *for publication must be accompanied by the name or card of the writer.*

Coming Technical Meetings.

Engineers' Club of Philadelphia, Pa.—Next meeting Jan. 18 Secy., Howard Murphy, 1122 Girard st.

Michigan Engineering Society—Annual meeting at Detroit, Jan. 21, 22, 23 Secy., F. Hodgman, Lamax, Mich.

Western Railway Club, Chicago, Ill.—Next meeting Jan. 21. "The Ventilation of Cars." "The Efficiency of the Lick as compared with other Valve Motions." Rooms in the Phoenix Building. Secy., W. D. Cross man.

Engineers' Society of Western Pennsylvania.—Next meeting, Jan. 21. Secy., S. M. Wickersham Pittsburg, Pa.

Ohio Society of Engineers.—Annual meeting at Columbus, O. Jan. 21 22, 23.

Boston Society of Civil Engineers.—Next meeting, Jan, 21. Secy., S. E. Tinkham, City Hall.

Engineers' Club of St. Louis, Mo.—Next meeting, Feb. 1. "Fuel Gas," W. B. Potter. Secy., W. H. Bryan, 809 So. 7th St.

Engineers' Club of Kansas City, Mo.—Next meeting, Feb 8. Secy., Kenneth Allen, 200 Baird Building.

In the New York Dock Department investigation, which was resumed this week, the City's attorneys seem to be wofully muddled as to the difference between the engineer's estimate of "probable quantities," preceding the execution of work, and the final measurement of quantities upon which the contractor is paid. No engineer need be told what this difference really is; but we cannot help advising the counsel for the prosecution to speedily obtain the definition of these terms from some engineer of undoubted repute, and to meanwhile read the note immediately following "the engineer's estimate of the nature, quantities and extent of the work" on all contracts as issued by the Dock Department. If the City's counsel are ignorant and honestly thirst after knowledge in this direction, they can readily understand that the "probable quantities" are *not* pay-quantities at all, but are only intended as a general guide to the bidder, and by the contract [each bidder is compelled to accept them as probable, not actual, quantities. They cannot be otherwise than estimates, for no correct measurement of mud to be dredged can be made in place previous to execution. The objection made by the learned counsel to measuring mud in scows is a little too absurd for answer here; though we may later give a technical description of the measurement methods of this department—which we now well know—as a matter of general interest, and to explain to engineers at a distance that the practice of the New York department is really much more stringent in this matter of measurement than is at all usual on private work, or even upon the average work executed for the Government and for other cities.

In the report of the Maine State Railroad Commission, just issued, the automatic coupler question is taken up, but in a rather misleading way. It is gravely stated as the opinion of the Commission, "that the action taken by the Master Car Builders' Association in the adoption of the 'Janney type' of coupler, has tended more to hinder than to promote the general adoption and use of the automatic coupler."

It is, perhaps, not strange that the Commission should form this erroneous opinion, since none of the roads over which they have jurisdiction and none of the roads in neighboring States have as yet made a single move toward equipping their freight cars with vertical plane couplers. If the Commission had taken pains to inquire what the principal roads in other sections were doing in the matter, they might have formed a more correct idea of the actual results of the Master Car Builders' action in this matter. The incident is a good illustration of the errors into which any State Board of Railway Control is very likely to fall. Its horizon of observation is so narrow, being confined for the most part to the limits of a single State, that it may prove a hindrance rather than a help in the introduction of important reforms.

With regard to the car-heating question, however, the Maine Commission seems to have secured information from much more reliable sources. Although the use of independent heaters is still the most common practice "down East," the Commission have learned that "experiments in heating by steam from the locomotive have shown it to be feasible; and the methods used have been satisfactory to both passengers and railway officials."

The Commission evidently realizes the difficulties which are in the way of State action concerning safety appliances, for they express explicitly their belief, "that all attempts on the part of individual States to legislate as to the character or kind of safety appliances, especially on freight trains, must, by reason of conflicting laws, result in hindrance and loss to railroad corporations and failure to accomplish the object desired."

New York's claims to the world's fair were ably advocated before the Senate committee this week by Chauncey M. Depew, his most telling points being a satire of the 500 mile radius theory by making an argument of the same kind in favor of his birthplace, Peekskill, N. Y., and the figures advanced from the Paris Exposition to show that the population in the immediate vicinity of the site was the real telling factor. Comparing on this basis, Mr. Depew pointed out that there is one Chicago on the Jersey City side of the Hudson River, a Chicago and a half on New York island, and another Chicago east of the East River in Brooklyn and vicinity, or three Chicagos and a half in all within easy daily reach of the fair. This will not be pleasant reading for Chicago, which is fond of comparing itself with the corporate New York only, and thinking of itself as almost as big, but it shows in its true light the real comparison. There can be no question, we think, that the attendance at an equally attractive fair would be fully 50 per cent. greater at New York than at Chicago, and perhaps nearly double, while the chances are equally strong that the fair itself will be more attractive and impressive at New York, especially in respect to the foreign exhibits. Moreover, as Mr. Depew well pointed out, if every man in the country who was familiar with neither city were given the money to go to either one he chose, the first choice of 99 per cent. of them would be New York, so that we have no doubt the attendance from distances exceeding 50 miles would be fully twice as great at New York as it would be at Chicago. The site chosen too, although we do not think it was the best available, and regret exceedingly that the opportunity for a permanent exposition building on an enlarged Governor's Island was not availed of, is still a grand and beautiful site, the finest by far which any World's Fair has yet occupied.

The interest shown by prominent New Yorkers in the fair seems to be increasing, and we are pleased to note also that it is now coming to be universally admitted that it is idle to even hope to open the fair in worthy form in the spring of 1892, wherever it is held, a view which we believe we were the first to urge. The prevalent idea seems now, to have some important ceremony on Oct. 12, 1892, the quadri-centennial of Columbus' actual discovery, and postpone the opening of the exposition until the following spring, a course which seems the more sensible because the year which it is desirable to commemorate is the year *beginning* Oct. 12, 1892, and it seems natural that all the important ceremonies of corner-stone laying, etc., should begin with that year. Even then the time will be none too long, especially if the commission invite, as we earnestly hope they will, plans for a single vast structure in stories, which can be permanent, occupying say eight or ten acres with four or five times that floor space, and thus (if designs of sufficient merit are received) break in on the tedious monotony of an endless series of one-story buildings. The design of such a structure would give a grand opportunity to an architect of genius, and would be something so novel, if properly planned, as to constitute a much more effective attraction than a mere copy of the Eiffel idea, since it would have real novelty, which an imitation of the Eiffel wer would lack.

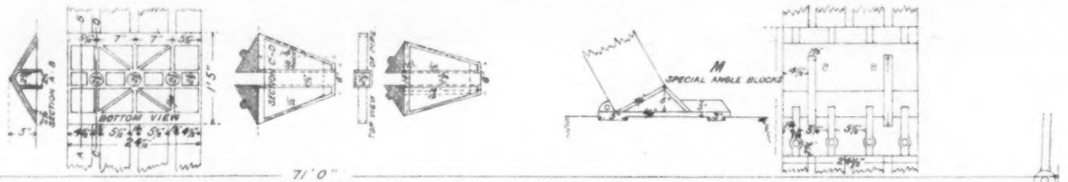
The Development of the Locomotive.

Our attention has chanced to be attracted to a paper with the above title read before the Canadian Society of Civil Engineers by Mr. T. T. Vernon Smith, of Ottawa, Can., and published in the Transactions of that Society for 1889, which contains singularly numerous errors, many of them of a kind which can hardly be considered excusable especially when the author is assuming to correct the errors of others, and hence might be expected to be particularly cautious lest he himself fall into error.

When a paper of this kind is given the countenance of publication in the Transactions of a national engineering society,—and the

FREIGHT CAR TRANSFER BRIDGE.

PENNSYLVANIA RAILROAD, HARSIMUS COVE, JERSEY CITY.



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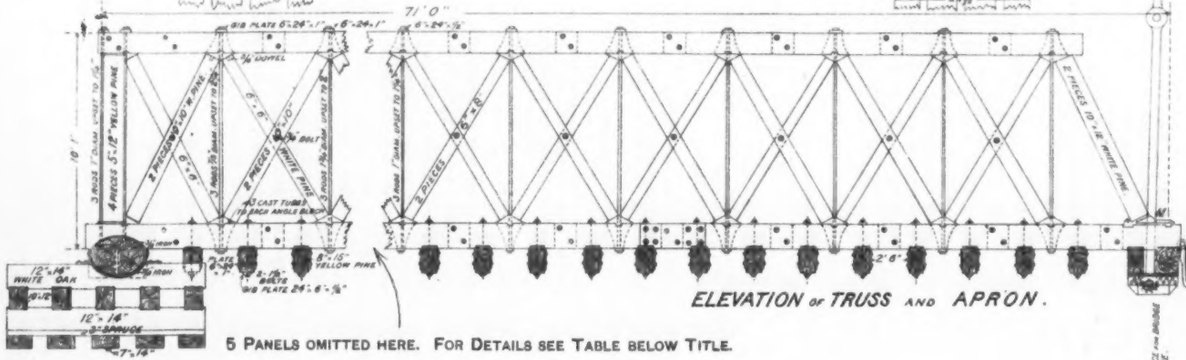

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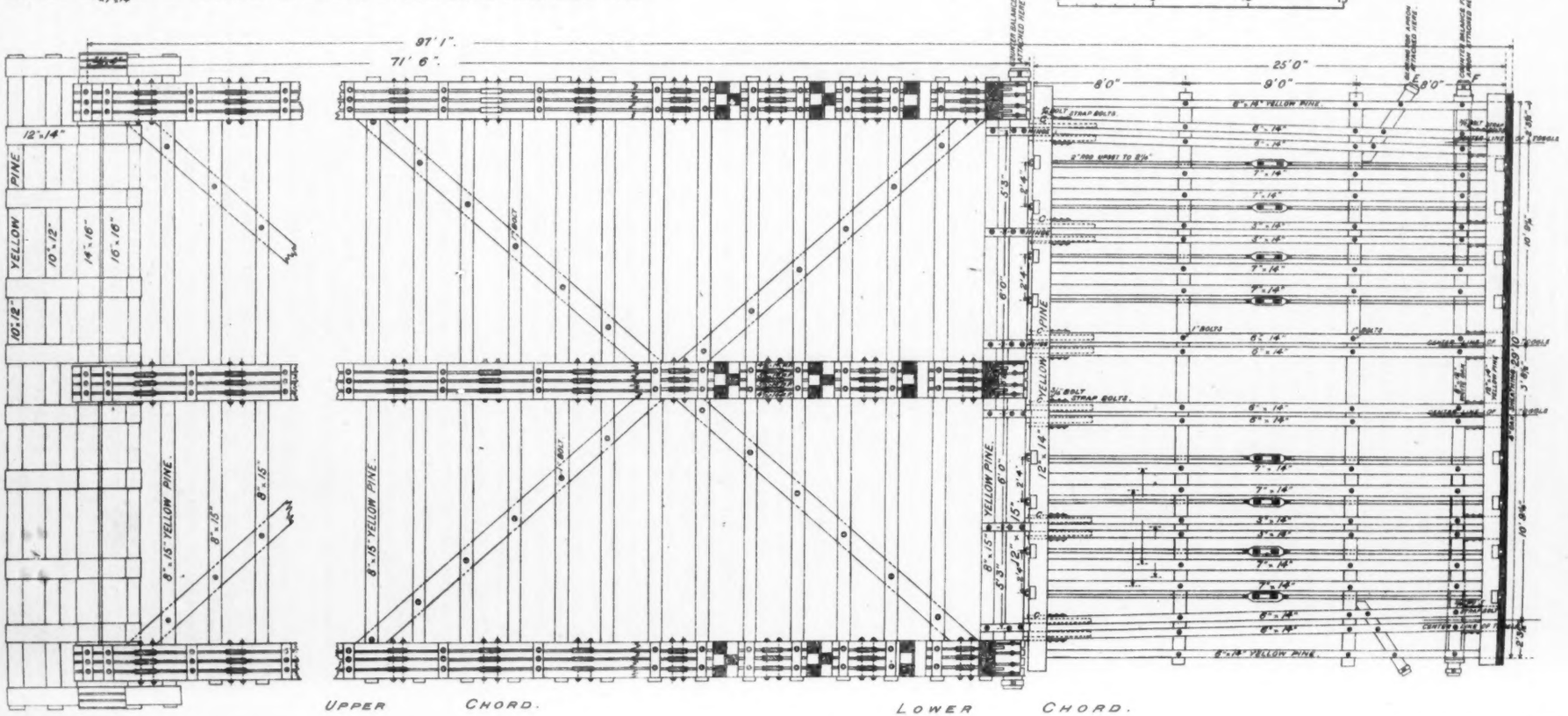

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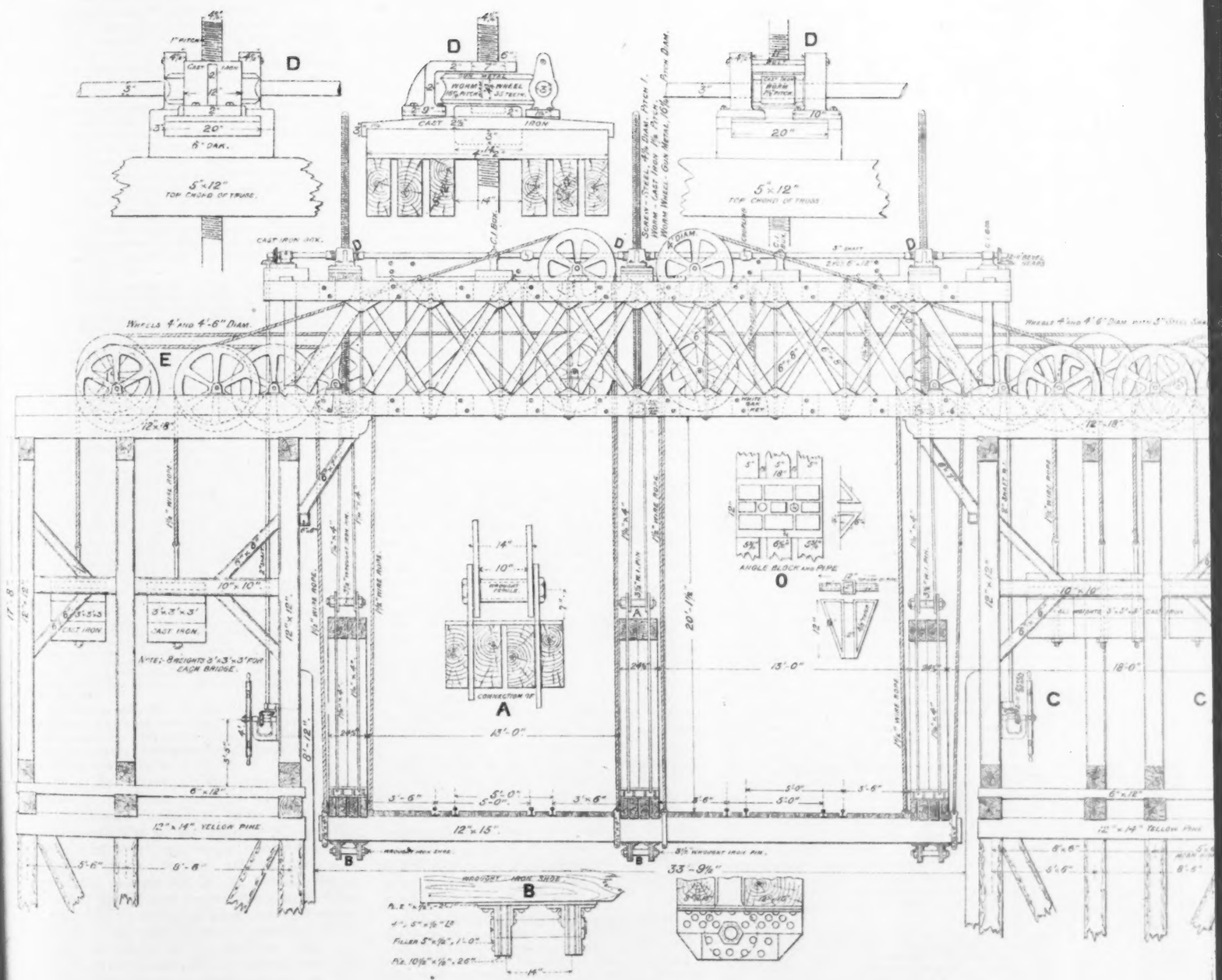

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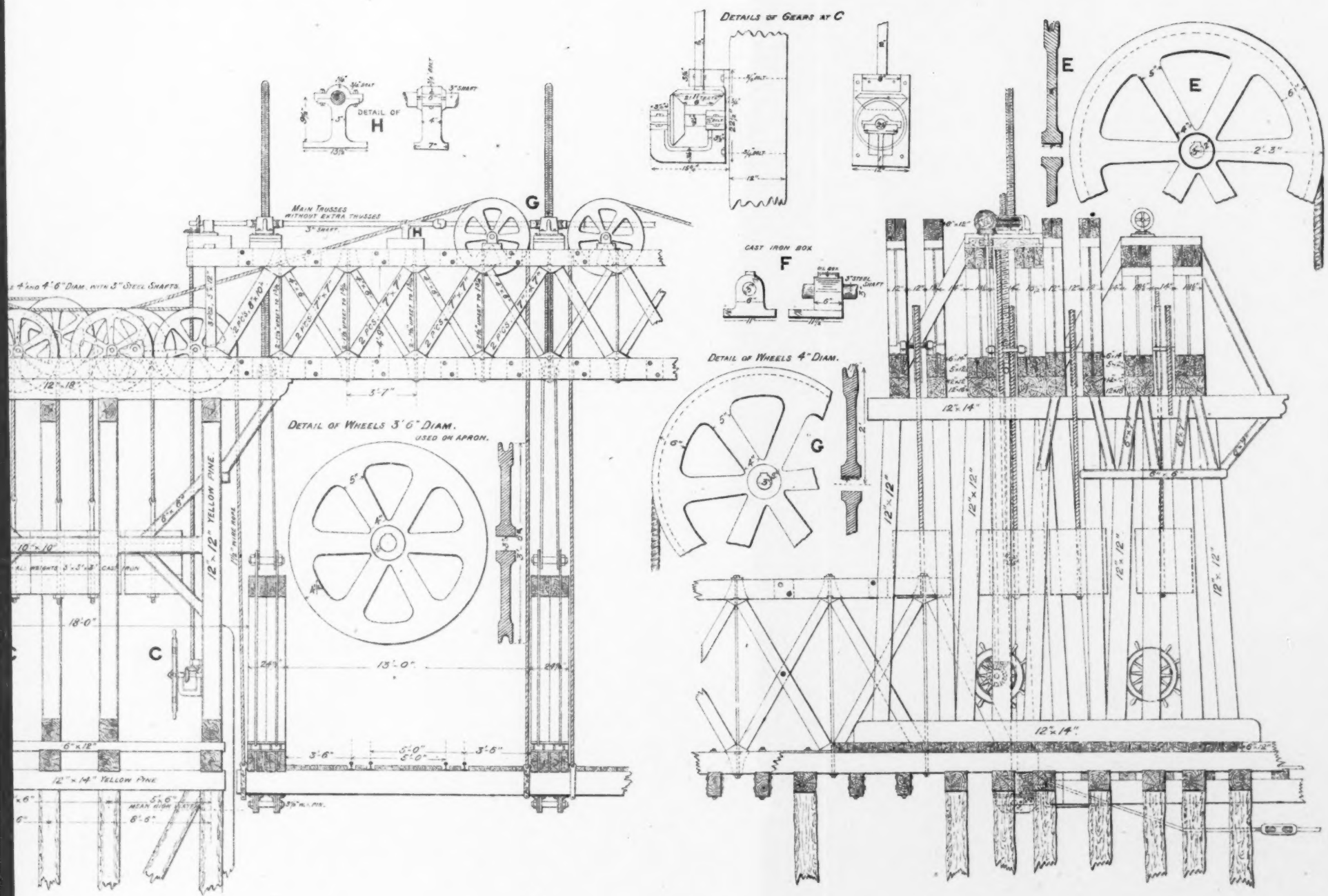

LONGITUDINAL SECTION THROUGH GALLOWS FRAME.

CHAS. HART & SONS LITH. 30 VESEY ST. N. Y.

Canadian Society may claim to be such,—it acquires an importance not its own, especially when followed by a score or more of discussions, in each of which the truth of the statements of the paper is taken for granted, and in no one of which are they questioned. As a clear majority, to say the least, of the important statements of this paper are in truth misstatements of facts (beyond question unintentional, yet equally beyond question due to inexcusable negligence in examination of records,) it appears important that the truth of history should be vindicated by a presentation of the real facts.

Mr. SMITH opens his paper by a reference to the series of articles on railways by various American engineers which have been appearing in *Scribner's Magazine*, his grievance against which he states as follows:

A series of railway articles have recently appeared in a leading magazine, which have been decidedly interesting and deservedly popular, but they contain a number of statements, which, designed to please American readers, are by no means correct in fact or generous to the engineers of other nationalities. Old country engineers have learned to regard railways and the locomotive, especially in its present form, as their undisputed invention and introduction, and although they are not so inconsiderate as to claim every individual improvement, yet they consider that in this one department of engineering, the great bulk of the evolution of the present railway has been peculiarly British, and that Americans have not contributed a great deal towards the mechanical and scientific triumph that we now see. The first number of these papers is particularly guilty and ungracious in claiming for American inventors everything valuable and important that has been found out as follows:

"The modern railway was created by the Stephensons in 1830, when they built the locomotive "Rocket." The development of the railway since is due to the development of the locomotive. The earlier locomotives of this country modelled after the "Rocket," weighed 5 or 6 tons, and could draw on a level about 40 tons. After the American improvements, which we shall describe, were made, our engines weighed 25 tons, and could draw on a level some 60 loaded cars, weighing 1,200 tons. The Stephenson type once fixed has remained unchanged (in Europe), except in detail, to the present day. When we come to the United States, we find an entirely different state of things. The key to the evolution of the American railway is the contempt for authority displayed by our engineers, and the untrammelled way in which they invented and applied whatever they thought would answer the best purpose, regardless of precedent. When we began to build our railways in 1831, we followed English patterns for a short time, but our engineers soon saw that unless vital changes were made, our money would not hold out, and necessity truly became the mother of invention. The first and most far-seeing invention was that of the swivelling truck, which enables the engine to run round curves of almost any radius. The swivelling truck was first suggested by HORATIO ALLEN for the South Carolina Railway in 1831, but the first practical use of it was made upon the Mohawk & Hudson Railroad in the same year. It is said to have been invented by JOHN B. JERVIS, Chief Engineer of that road. The next improvement was the equalizing beams, or levers, by which the weight of the engine is always borne by three out of four or more driving wheels. The original imported English locomotives could not be kept on the rails of rough tracks. Another American invention is the switch-back, by which the length of line required to ease the gradient is, obtained by running backwards and forwards in a zigzag course, instead of going straight up the mountain. This device was first used amongst the hills of Pennsylvania over forty years ago, to lower cars down into the Nesquehoning Valley."

Now this is sufficient to show the general style of claiming everything that has led up to the present development of railways for American engineers only. Excepting to the Stephensons, not one particle of credit is hinted at as belonging to any one.

That Mr. SMITH should judge the long series of statements which we have quoted to be "sufficient" for the end he describes shows a singular idea of sufficiency, first, because each and every statement quoted can be readily shown to be strictly true, and secondly, because Mr. T. T. VERNON SMITH himself proceeds to knock the ground from under his own feet a few pages later by claiming that the two principal devices whose American origin is objected to, viz., the locomotive truck and the equalizing lever, are really devices "of no consequence," as Mr. TOOTS might remark.

But before quoting the particular words in which Mr. SMITH advances this judicious opinion, we may notice what it is the main purpose of this article to correct, the historical grounds advanced for objecting to the above statements. As respects the switch-back, Mr. SMITH makes out his strongest case. He says in regard to it:

Touching the American invention of the switch-back, the claim of forty years' use in Pennsylvania is not sufficient. In TOM MOORE'S "Epicurean," written in 1810, a good forty years before that again, is a capital description of the switch-back, and by it the pretty priestess of the Egyptian temple saves the life of her lover. TOM MOORE wrote some of his finest poetry, including "Lalla Rookh" and the "Epicurean," in the heart of the lead mining district of Derbyshire, where the "switch-back" has been in use for a century, as a means of bringing the materials to the smelting works in the valleys. All that American engineers invented in this contrivance was the name.

To prove a negative is all but impossible, and therefore we cannot undertake to show affirmatively that the "mining district of Derbyshire" or of any other shire or country, did not have the switch-back in use forty or four hundred years before the first known and so called switch-back was constructed in Pennsylvania. This happens to be a subject to which the present writer has given especial attention, however. He has read a large number of English and other comments on the Mauch Chunk switch-back and inclined plane, which is universally spoken of as in its day a great engineering novelty, and this is the first instance within his knowledge in which a claim to the prior use of a like device has been advanced; and neither he nor any one is bound to accept Mr. VERNON SMITH'S dictum, unsupported by facts and details, as to what existed a century ago in Derbyshire, especially as Mr. SMITH'S other engineering authority, Mr. TOM MOORE, does not describe an at all equivalent device in the tale to which Mr. SMITH refers. The query naturally arises: Supposing Mr. TOM MOORE had dreamt of a switch back in connection with a pretty priestess and her lover, what does that matter?

We pass, however, to more important matters, as to which Mr. SMITH is more specific, and as to which, consequently, we can be more specific likewise. As to the American type of double-truck passenger car, he says:

The double-trucked car for instance, which in the magazine is claimed as the invention of Ross Winans, was in use *for carrying timber and long stuff* [all italics ours, ED.] before there was a road in America at all; and the passenger car out of which Mr. HUSKISSON descended to meet his death, on the memorable day that preceded the opening of the Liverpool & Manchester Railway was a double-truck car *much* as we now see them, and what was more, it had seats with reversible backs, such as are now universal in America, though they were never commonly used in England. This identical car was only used on the Liverpool & Manchester for a short time, and was subsequently sold to the Newcastle & North Shields, where numbers may still remember it as being occasionally used on the Sunday trains.

The pertinency of the last claim, which is one we have never heard advanced before, may be judged from the following description of this car, the most elaborate we can discover, which we find in the "Mechanics' Magazine, Museum, Register Journal and Gazette" of Sept. 25, 1830 (p., 65), by which long-winded title the leading engineering journal of that time was known. The description is given in an account of the opening of the Liverpool & Manchester Railway on Sept. 15, 1830, on which day Mr. HUSKISSON was killed.

The Northumbrian (locomotive) was appointed to take the lead of the procession (of eight trains) drawing a splendid carriage, appropriated to the reception of the Duke of WELLINGTON, Sir ROBERT PEEL, and about 30 other distinguished individuals who honored the ceremony with their presence. Each of the other locomotives drew 4 carriages, containing between 80 and 90 persons, so that the total number of individuals accommodated with seats in the procession must have been about 600.

Here there is not a word of this having been a double truck car. Neither was this car alluded to in the great Winans patent suit of 1835-53, when, if it was really such as described, the patent would have been quashed at once, since Winans only claimed to have invented the double-truck car in 1830-31, and only took out his patent in 1834. His patent was quashed, but [on account of prior use by BYRANT of the Quincy (Mass) Granite R. R., JERVIS and ALLEN. This suit involved millions of dollars before it was finally decided, and the whole earth was ransacked for evidence; yet although this alleged car would have been fresh in the memory of thousands at that time, it was not even alluded to in the evidence, so far as we can discover: nor adduced as a reason for quashing a patent which it would have at once invalidated.

Therefore, we do not believe, nor should any one believe without further evidence, that any such car, "much as we now see them" ever existed; which makes it the more pertinent to inquire: Suppose it had existed, what of it? A single car of this kind, built from special motives of display, and never duplicated, proves nothing, any more than does the piling of long timbers on two cars or trucks at once, which we may well believe has been done at times for centuries. The invention as an invention was the perception of the fact that this was a type admirably adapted for the construction of all railway vehicles, or of certain classes of them, and greatly facilitating the cheap construction and safe operation of railways.

The climax of the historical errors of this paper, however, is reached in the grounds advanced for a renewed claim of English origin of the locomotive truck, or "bogie," a claim which we have twice before shown to be groundless, but now hope to put a final quietus on. Mr. VERNON SMITH advances this claim in the following words, which contain such numerous misstatements of fact that the simplest way to correct them will be to interpolate the real facts in brackets:

As the invention of the truck is claimed almost universally for America, and as it has subsequently become a prominent feature in American locomotives, it may be as well to place on record a few facts, that at least go to prove that the Newcastle shops had something to do with the invention. HORATIO ALLEN was sent to England by the Delaware & Hudson Canal Co., in the fall of 1828 [January, 1828,] to examine the English railways, and with instructions to order two or three [three] locomotives.

He found STEPHENSON'S works crowded with work and unable to take his order, so that it was finally placed with Foster & Rastrick, [Two engines ordered of STEPHENSON, and one only of Foster, Rastrick & Co., and the last only to have it built with a flue boiler, but it actually had a tubular boiler. It still exists and was exhibited at the Railway Exposition in Chicago in 1883.] The "Stourbridge Lion," the first of the locomotives, was delivered in May 1829. [The three locomotives together were delivered in the winter of 1828-9] and was probably the first locomotive, ever seen in America.] It was intended that this engine should open the railway to the mines on July 4, but the locomotive did not arrive till the 23d, [arrived at Honesdale, Pa., in spring of 1829, on opening of canal navigation], and was tried on Aug. 1 [Aug. 9]. The engine, which was of the Killingworth type with two flues [the boiler was tubular, and had no flues at all], was a perfect success, but the road, of hemlock longitudinals 8 in. x 10 in. (6 in. x 12 in.) and a strap rail, spiked down to cross sleepers, 10 ft. apart, was too light to carry the weight, and as the expense of altering it was deemed too much, the engine was housed in a shanty for some years. The boiler was afterwards set to work at Carbondale, and the rest of the machinery was never used.* The second

* Mr. ALLEN himself says about this trip: "How it happened that the Stourbridge Lion was sent (to Honesdale, for the trial) I have no knowledge. In reference to future events it is to be regretted that one of the Stephenson locomotives was not sent, for the reason that the locomotives built for the Delaware & Hudson Canal Co. by STEPHENSON were the prototypes of the locomotive Rocket, whose performance in October of the same year so astonished the world. The two locomotives from STEPHENSON that were in New York early in 1829, and therefore prior to the trial of the locomotive Rocket in October of that year, were identical in boiler, engines, plan and appurtenances with the Rocket, and if one of the two engines in hand ready to be sent had been the one used on Aug. 9, the performance of the Rocket in England would have been anticipated in this country.

engine [there were two others] was probably never set to work, at all events, as a locomotive. The first English engine that was actually worked in America was the "Robert Fulton" [this is correct] built by Robert Stephenson & Co., and the drawings which accompanied it were dated July 4, 1831.* In the winter of 1832-3 [plan for alteration prepared in fall of 1831, and sent to West Point Foundry and engine on track in summer of 1832,] this engine which was of the Planet class, was altered and fitted with a truck similar to the Experiment engine then on the Hudson & Mohawk [Mohawk & Hudson] Railway, under the direction of J. B. JERVIS, and re-christened the "John Bull." It is probably this incident, that has led to an error in attributing to Mr. JERVIS the invention of the truck. In looking over the old drawings in Stephenson's office, there is a difficulty in tracing the consecutive numbers, from the fact that in some cases the railway, or party ordering the engine, is put in place of the number on the drawings. Some of the locomotives were thus built to numbers and some to names, but the presumption is that the numbers, where traceable, are consecutive. The "Rocket," as before stated, was No. 19, and was built in 1829. The engine for America referred to above has on the drawings "Stevens, New York," built in 1831. [This was quite another engine, as below stated.] In the same year No. 31 for the Stanhope & Tyne, No. 36 for the Leicester & Swannington—the first 6-wheel connected engine—and No. 37, a similar engine sent to the Liverpool & Manchester, are so marked. The next number still in 1831 [this engine was not placed on track till the summer of 1833, and is distinctly stated by JERVIS not to have been ordered till the success of the "Brother Jonathan" was assured, that is, not till after the summer of 1832. This alleged stop date of 1831, therefore, is an error], is No. 42, ordered by the Saratoga & Schenectady Railway, an engine with 9 x 14 in. cylinders, one pair of 4 ft. 5 in. driving wheels, and a truck with 4 wheels 2 ft. 8 in. in diameter. [This engine was ordered Jan. 12, 1833, shipped from Newcastle April 6, 1833, and set to work July 2, 1833.] In the same year is an engine, but without a number, for the Hudson & Mohawk with 10 x 14 in. cylinders, with 4 coupled wheels 4 ft. in diameter. In 1832, No. 52 is simply marked United States, and was a Planet engine with a single pair of drivers 5 ft. in diameter. No. 61 and "Brother Jonathan" in the same year were truck engines built for the Hudson & Mohawk, and so was No. 75 for the Saratoga & Schenectady, all three being 10 x 16 in. engines, with 4 truck wheels 2 ft. 8 ins. in diameter. In 1833, three engines were built for the Newcastle & Frenchtown Railway of the Comet class with 4 coupled wheels.

The Hudson & Mohawk [Mohawk & Hudson] Railway was opened September, 1831, and some time after, but probably before the end of the year, a locomotive called the "De Witt Clinton," built at West Point Foundry, was put upon the line, being the second [third] locomotive built in America, the first [and second] having been put on the South Carolina Railway in 1830 [and 1831] and having exploded the next year. Both were four-wheel engines. In Appleton's Encyclopædia we are told that in August, 1832, an engine called the "Experiment" was placed on the Hudson & Mohawk with four swivelling wheels, built by ADAM HALL of the West Point Foundry. Now, putting all these stories together, it seems that in 1831, Stephenson's No. 42, the first locomotive with the four-wheel truck, was put upon the Schenectady road, and at the same time Stephenson sent an engine of the Planet class to the Hudson & Mohawk, which two years after was called the "John Bull." In 1832, Stephenson sent two engines to the Hudson & Mohawk and another to the Schenectady line, all with the truck. In August of that year the West Point Foundry put on their "Experiment," *probably a copy of the Stephenson engines* (italics ours) and during the following winter, the Stephenson engine, "John Bull," was altered so as to be like the three-truck engines that they already had.

Now let us see what germ of truth there is in all this medley of historical mis-information. We premise that our authorities (not more especially noted) for the preceding and following statements are "The First Five Years of the Railroad Era," a pamphlet by HORATIO ALLEN published in 1884; "Railway Property," by JOHN B. JERVIS, published in Philadelphia in 1869; and the "History of the First Locomotives in America," by WILLIAM H. BROWN, Philadelphia, 1877, all well-known publications, and easily obtainable by any one desiring to write correctly on historical facts.

In the first place, there never was a "John Bull" locomotive on any of the early New York roads. The first passenger train ever run in America, was over the Mohawk & Hudson road, on Aug. 9, 1831, precisely two years after HORATIO ALLEN's first trip in a locomotive, by a singular coincidence; and this train has often been said to have been hauled by an English engine "John Bull," but it was actually hauled by the American-built "De Witt Clinton," the third engine ever built in this country, the first two having been for the South Carolina Railroad. The true and only "John Bull" locomotive was the "Stevens, New York" engine mentioned above, shipped from the Stephenson works to the Camden & Amboy Railroad, This engine still exists and is illustrated and described in another column. It has now (but did not have when received in this country) a curious-looking projection in front, which, especially in small views, looks very much like a two-wheeled "pony" truck, and we suspect that this, which is really a comparatively modern addition to the engine, is the true source of the claims which keep coming from English sources that Stephenson built the first truck engine. This projection, however, is simply the embryo form of the familiar "cow-catcher," which at first was supported on a pair of independent wheels, as elsewhere explained.

The statement that the Saratoga & Schenectady ordered a truck engine in 1831 is an absolute error. The road was not opened till 1832, JOHN B. JERVIS having been appointed Chief Engineer in 1830. Mr. T. T. VERNON SMITH evidently gets his information about the early Stephenson engines at second or third hand, and he has simply confused the dimensions and details of one engine with the date of another.

That this is so is easily shown, and should have been evident to Mr. VERNON SMITH from his own statement of facts, he being also familiar, as he shows himself to be by references, with Mr. JERVIS' "Railway Property." If a truck engine was ordered of the Stephenson works by any one in 1831, for the S. & S. R. R., it must have been by Mr. JERVIS, since he was Chief Engineer of the road. Now Mr. JERVIS, in 1833, before there was the least reason to believe that this device would become one of world-wide importance, and while all the facts were still fresh in the memory of thousands, wrote a letter to the *American Railroad Journal*, then just established, narrating in detail all the circumstances connected with the truck (vol. ii. p. 468) and this letter is republished in full in his "Railway Property," p. 160. In this letter, as also in the book, he states in detail how, "after devoting a good deal of labor to this subject, *I prepared a plan*" for an engine in the fall of 1831, after previous experimentation with an English four-wheel engine on the Mohawk & Hudson, for an American built truck engine [the "Brother Jonathan"] for the same road, placed on the track in the summer of 1832. "The working of this engine satisfied me that the truck principle would be successful. I then prepared a new plan for an engine on the Saratoga & Schenectady, following substantially the same plan, and sent it to GEORGE STEPHENSON, Esq., of Liverpool, who constructed the engine, and it was placed on the S. & S. Ry. early in the following summer (July 2, 1833)."

Now in view of these statements, published far and wide by Mr. JERVIS then, and since repeated on oath, and in much detail, in the testimony in the Winans suit on this very question, always to the same purpose, and never with any contradictory testimony, it is obviously impossible that the Stephenson works should have shipped such an engine to this country in 1831, which in that case would have been the first truck engine in this country, and must have been ordered by Mr. JERVIS himself. This is supposing Mr. JERVIS to have been a man capable of claiming an undeserved honor for himself if he could, but, as a matter of fact, he was a man of unblemished and unquestioned honor,—the most unassuming of men, and one of the greatest engineers of his age or of any age. It is most unbecoming, consequently, that a claim never advanced by the Stephensons or any one else, until very recently, should now be advanced for the first time, after all the original witnesses are dead, as it repeatedly has been within the last four or five years, on the strength of the obscure and dubious records of the Stephenson drafting office.

We can follow the absurdities of this article but little further. No attempt is made to support by evidence the claim that the equalizing lever is of English origin. (It was really first used by Eastwick & Harrison in 1837, HARRISON taking a patent in 1838.) Instead of this, the bold claim is made, which we need not dispute that:

> This contrivance, although perfectly well known in Europe, is not deemed of any great importance where the railways are in good condition. It is by no means essential, nor is it as a rule adopted on some of the leading railways, where the best designs are taken regardless of expense. It is absurd to mark these [both the equalizing lever and "bogie" truck] as important developments of the locomotive, comparable to the blast pipe multitubular boiler, link motion, or the French invention of the injector.

A page further on Mr. VERNON SMITH remarks as follows:

> Again, "The climbing capabilities of a locomotive upon smooth rails were not known until, in 1852, Mr. LATROBE tried a temporary gradient of 10 per cent. This daring feat has never been equalled." Now this statement is somewhat rash. The question of gradients and adhesion was about as exhaustively gone into on a score of private railways in England as it could be before the experiments on the Cromford & High Peak, made in the interest of the Mont Cenis Railway, conclusively settled the maximum gradient that it would be safe to use across the Alps previous to the opening of the Mont Cenis tunnel. With ordinary locomotives a 10 per cent. rise is not practicable.

The statement to which Mr. SMITH here objects might well have been made much stronger. While yet it was being debated in England whether 1 per cent. grades were really practicable for locomotives, in 1832-3, Mr. B. H. LATROBE resolved on 116 ft. per mile grades for the Baltimore & Ohio, after experiments which led him then to declare that 6, 8, and 10 per cent. grades could be operated by locomotives, a conclusion he did not test in extreme form until 1852, as stated, but in the mean time numerous other heavy grades of 2 to 6 per cent. had been built and operated. On the other hand, the Fell experiments were not started until long after LATROBE, ELLET, and others had located their very heavy grades. The historical fact that the capabilities of the locomotive for heavy grades were first discovered and developed in this country is so well established that it is amazing to find it thus questioned. But even more amazing is it to read the following statement on the last page of the paper, called out by the charge that there had been little change in European locomotives from early types:

> As far as the locomotive of different countries is concerned, the fixity of type, the absence of change, the slavish following of precedent, is to be seen now more in America than anywhere. You travel from New Orleans to Montreal, from New York to the Pacific, and *you see nothing but the one type of locomotive, unchanged for forty years, the American 8-wheel, 4-coupled driver, truck engine*, with inside frame and outside cylinders, and its Swedish iron laggings, and its monotonous uniformity.

Perhaps we are wasting space in discussing the statements of any one capable of penning such a sentence as that. We should not have done so except for the semi-official endorsement given to his paper by publication in the Transactions, and at any rate we will waste no more. When one remembers the Mogul, Ten-Wheel, Mastodon, Consolidation, Double-

* By Mr. JERVIS description, ("Railway Property," p. 156) it had four wheels, all drivers and weighed about 7 tons, the axles 4½ ft. apart, the frame 12 ft. long and projecting nearly 4 ft. each way beyond the axles.

Ender, Forney, and other types which are running in thousands in this country, the views as to the past of any one so ignorant of the present as the above sentence indicates, cease to be important.

The Caisson Accident at the Jeffersonville Bridge.

As yet no really definite and technical explanation can be had concerning the caisson accident of last week at the new Louisville and Jeffersonville bridge. The best newspaper account is contained in the Louisville *Courier Journal*, and from this account the following points may be gathered:—

The caisson was of the usual type, built of 12 by 12 in. timber and about 50 ft. long by 21 ft. wide with a working chamber 7 or 8 ft. high. It was provided with a 3-ft. air-lock shaft 32. ft. long, a 2½ ft. supply shaft, and two blow-off pipes. The air-lock had a bottom and a top door, both opening downward as usual; but as the plans were made in Louisville, Ky., it cannot be definitely stated whether these doors were provided with catches or not: it has been the common practice to omit these catches for some time. At the time of the accident the cutting-edge of the caisson was about 30 ft. below the surface of the water and in sand.

It might be stated here, for general information, that in work of this nature, there are always two lock-tenders, one inside the lock to manipulate the valves and open and close the lower door, and one outside on top, who attends in like manner to the upper door. These d ors have a valve in each for equalizing pressures, are hinged on one side so as to open downwards, and as they are usually quite heavy, a block-and-fall is provided for pulling them up and this tackle can also be used for holding them up in case of a sudden relief of pressure beneath. The doors are usually made of plate-iron with a rubber gasket, and fit snugly against the under side of the floor and roof of the caisson.

As described in the *Courier Journal*, the foreman, JOHN KNOCH, passed his men through the lock and into the working chamber of the caisson at 4 P. M. and set them at work digging a trench about 18 ins. deep under one side of the caisson, apparently with the intention of leveling up the caisson. About 5.40 P. M. this trench was made, and KNOCH proceeded to relieve the pressure in the usual manner, to settle the caisson, and the accident immediately followed.

The accounts conflict as to the conditions existing at the time. MICHAEL WALSH, the upper lock-tender, says that the upper door was removed at the time for the purpose of adding a length to the air-lock shaft. Another account says that BALDWIN, the lower lock-tender, was not at his post, but was outside of the air-lock and tried to come down, and "the opening of the upper door, which held the compressed air in, gave it an exit." This last account does not seem probable. The sudden release of pressure may be ascribed to a "blow-out;" but from whatever cause, it seems to be an undoubted fact that the lower door fell open as soon as its weight overcame the difference in pressures. Under this condition the air-lock, if closed as stated at the top, would also have been filled with compressed air, and BALDWIN could not have opened the door, had he wished to do so, without first letting off the pressures from the lock and the whole chamber.

With the newspaper accounts alone used as data, the accident may be explained as follows: BALDWIN was undoubtedly absent from his post, as he was saved and was not one of the four who escaped through the air-lock. The lower door was open, for these four men escaped through it, and the bodies of other men have since been found jammed in the lock-door, and the lower part of the lock was filled with sand. A "blow-out," familiar to users of compressed air, would explain the sudden release of pressure, and this is an event not always possible to guard against. But BALDWIN should have been at his post, and had he secured his door, by the tackle or otherwise, it could not have fallen and the accident would not have been necessarily a fatal one.

In regard to the reported removal of the upper door; this under the plan was necessary to lengthen the air-lock shaft, and as the top of this shaft was only 32+8=40 ft. above the cutting edgeof the caisson, and the water and sand 30 ft. deep above this edge, it was time to lengthen it out. But this operation should have taken but a short time, and KNOCH would be wrong in attempting to settle his caisson, always a more or less delicate operation, while this upper door was removed. By doing as reported, instead of having two doors closed between himself and danger, he would have only one, and that one unattended.

The reports as to weakness in the caisson itself seem unfounded. This caisson was built under the direction of a contracting firm of long experience, who would have a lively appreciation of the dangers to themselves, personally and pecuniarily, of any faulty design. Besides this, the latest reports say that the water had been forced out of the caisson, consequently it must be practically uninjured. From the latest accounts the supply shaft must also have blown out, as water and sand are said to have spurted 50 ft. high from this shaft at the time of the accident. As we do not know just how this shaft was arranged in the present case, its bearing upon the accident is uncertain.

The accident itself occurred at 5:40 P.M., on Jan. 9. The bridge contractors are the Phœnix Iron Co. and SOOYSMITH & Co., of New York, were the con tractors for the foundations. Fourteen men lost their lives, all but five of whom were colored men; four men escaped through the lock with the first out-rush of air. The foreman is said to have been an experienced man in similar work.

Since the first part of this account was in type an interview with Mr. CHAS. SOOYSMITH has appeared in the *Courier Journal*. Mr. SOOYSMITH says that this first fatal accident on any work under the charge of his company is still a mystery to him as far as the direct cause is concerned. There has not yet been time to fully examine the inside of the caisson, and to discover what was done there that might have brought about the observed results. In fact, as all the responsible agents are dead, it will be difficult now to discover exactly what events did precede the accident.

Mr. SOOYSMITH emphatically denies the charge that KNOCH was an inexperienced or careless foreman. KNOCH worked for his firm in similar caissons at the Sibley Bridge and at other places, and his work had been considered good and he a careful man. He might not have been a popular foreman, but his popularity had nothing to do with his efficiency as a workman.

The only explanation that could be given by Mr. SOOYSMITH was reported as follows in the *Courier Journal*:

I am quite confident that it all occurred in a moment and without warning. When Knoch went to blow off the air in the chamber to settle the caisson lower on one side, if there had been any sign of what was coming he could have turned on the valve and let the air come in again, and stopped its escape. But I think there was a sort of quicksand, and that without warning this sand gave way, let the caisson fall on one side, and in a moment the interior was being deluged with sand and water, and there was no time left Knoch to stay the flood by the usual precaution. The men who were found there became wedged in the lower floor, leaving space for air to escape from the chamber. When the upper door was opened by the four who escaped, if there had been no obstruction, the lower door would have closed automatically; but as the men were obstructing it, the pneumatic arrangement was defeated, and when the upper door was opened the air escaped, leaving no resistance to the flood of sand and water. This is only a theory, and is based on the principle that sand is treacherous and liable to give way when least expected.

According to this explanation the upper door was in place and was opened by the escaping men. But to have done this the "blow-out," which apparently started the accident, must have been so thorough and complete as to have almost entirely relieved the pressure in the caisson and in the air-lock shaft; otherwise the upper door could not have been opened almost instantaneously as must have been the case to account for the suddeness of the accident. But as any explanation, based upon the very apparent confusion of statements, must be as yet theoretical, it is only fair to suspend final judgment until the real facts and accompanying conditions are gathered together, as they doubtless soon will be.

THE Pennsylvania Railroad Company has introduced car building at the Altoona (Penn.) shops. Six chair cars have just been completed and will be used on the Camden and Atlantic line.

M. C. B. and Other Automatic Couplers.

In our issue of Jan. 4, we published a letter under the above head from Mr. R. C. BLACKALL, Superintendent of Machinery of the Delaware & Hudson Canal Co., stating, among other things tending to work against the further introduction of M. C. B. standard couplers, that "already the numerous breakages show conclusively that the adoption of the M. C. B. type would prove a costly luxury for this company," and also, "It is a notorious fact that many of the most pronounced advocates of the vertical plane type are already weakning in their allegiance, and frankly confess that they were too hasty in concluding in its favor." As we stated in an accompanying editorial: "This is news to us. We had understood the notorious fact to be the direct reverse of this: and we shall be greatly obliged to any one who will give us the name of one such 'pronounced advocate' (supposed to be also a man whose position entitles his opinion to weight) who has thus 'weakened,' as we do not know of one. We do know that various people have had trouble with particular couplers, but not to our knowledge, such serious trouble as to lead them to condemn the type, after once advocating it."

No one since this date has volunteered to give us the name of any such person, but thinking it very important to determine accurately if there was any "notorious fact" of the kind stated which was unknown to us, we addressed letters of personal inquiry to a number of the higher mechanical officers of railways. Among the responses received (we omit some letters merely denying the statements as respects themselves without details, but none others) were the following:

Mr. JAS. M. BOON, Asst. Supt. of Motive Power of the West Shore Railroad, writes:

Referring to your inquiry whether my experience with the M. C. B. type of coupler has been such as to condemn its use, I would advise that it has not been. I have had considerable experience with three types of these vertical plane couplers, and I have seen no reason to change my opinion in thinking favorably of that type.

I have no knowledge of any trainmen being injured by them. Like all other new devices, when first applied, minor defects, due to workmanship or material, have developed, but, upon the manufacturers' attention being called to them, the defects have been promptly remedied.

The cost of maintenance of this style of coupler is so low, so far, as to be scarcely worth taking into account. Of course there are comparatively few in service, and it is too early to draw any general conclusions as to comparative cost of maintenance, etc.

Mr. JOHN KIRBY, General Master Car Builder of the Lake Shore & Michigan Southern Railway writes:

Replying to your favor of the 8th instant, I would say that I am unable to say as to who the person can be who is weakening on the M. C. B. type of coupler. Some of Mr. BLACKALL'S statements are true: they are those referring to the breakages and cost of maintenance, but this will occur with any automatic coupler which dispenses with the link and pin. Parties who have applied a great many of the Marks (not of the M. C. B. type, but Mr. BLACKALL'S favorite coupler) have abandoned it, and pronounced it a failure. We have been so long accustomed to the simple link and pin coupler that it has spoiled us for a more complicated coupler. We cannot get anything that will couple automatically and dispense with the link-and-pin, but what is somewhat complicated. I think that Mr. F. D. ADAMS shares Mr. BLACKALL'S feelings in regard to the M. C. B. type of coupler, but these gentlemen must bear in mind that this is not an age of retrogression and we are not going backward. This period of transition from one type of coupler to another would occur to any change of coupler. You will see from what I have said that Mr. BLACKALL was not quoting me.

Mr. ADAMS, of the Boston & Albany, referred to by Mr. KIRBY above, has never been an advocate of the M. C. B. type, so that he cannot have been one of the persons referred to by Mr. KIRBY.

Mr. ROBERT MILLER, Asst. General Superintendent of the Michigan Central Railroad, writes:

So far as my personal opinion with regard to the adoption of the vertical plane type of coupler is concerned, I have no reason to change my opinion with regard to its adoption. I can see no solution of the difficulties except to adhere to the action already taken with regard to freight car couplers. While I must admit that during the change from the old pin and link coupler to the vertical plane type, the danger will be increased, and the cost to maintain, and the breakages be more, still it seems to me a foregone conclusion that when the changes are com-

pleted, it must be a success. The best evidence to me of this is the fact that the vertical plane type of couplers are in universal use on all passenger equipmen in the United States, and who is there to deny that the are not a complete success. If a success on passenger equipment, why not on freight equipment? It cannot be otherwise.

It must be generally admitted that the last is a very strong point; and we may add, what we have before pointed out at more length, that the inevitable effect of the introduction of present passenger types of brakes and couplers into freight service will be to assimilate the handling of freight cars and trains to that of passenger cars and trains, with enormous resulting economies both in maintenance charges and (what is far more important) in the hauling of longer trains.

Mr. B. K. VERBRYCK, General Master Car Builder of the Chicago, Rock Island & Pacific Railway, writes:

In answer to your inquiry in relation to the statement of Mr. BLACKALL that many of the most pronounced advocates of the vertical plane type are already weakening in their allegiance and frankly confess that they were too hasty in favoring the M. C. B. type, etc., I would say that I have no means of knowing to whom Mr. B. alludes. It is the first I have heard of it, and I hardly think it can be any of our Western men. The best evidence that I can give you myself is that I am putting it on all the cars I rebuild, and on 600 cars we are now having built by contract, and that I have put it on all cars that we have had built since June, 1888. We have some broken ones, but so far, I do not think more in proportion than of others, and I think in time the manufacturers will discover all the weak points and remedy them, so that there will not be more trouble with breaking than with any other kind.

Mr. JOHN MACKENZIE, Superintendent of Motive Power of the New York, Chicago & St. Louis R. R Co., writes:

I have not confessed a hasty action in recommending the M. C. B. type of coupler, nor do I know of any one in the Mechanical Department that will confess to its having been a hasty decision.

I am satisfied that if the trainmen were educated to the use of the M. C. B. coupler, there would be less damage and less accident. It must be plain to every one, from a mechanical standpoint, that the general adoption will lessen damages, and almost entirely avoid personal injury.

Mr. ROSS KELLS, Superintendent of Motive Power of the New York, Lake Erie & Western R. R. Co., writes:

I would state in reply to your inquiry, that there is no officer in this organization, to my knowledge, who desires to discard the Master Car Builders' type of coupler. During the past year we ordered 2,500 cars equipped with this type of coupler, and all new cars building we will continue to equip in like manner.

Mr. W. H. THOMAS, Superintendent of Motive Power of the East Tennessee, Virginia & Georgia Ry., Memphis & Charleston R. R., Mobile & Birmingham Ry., Knoxville & Ohio R. R., and Walden's Ridge R. R., writes:

In regard to the statement made by Mr. R. C. BLACKALL, concerning the vertical plane type of coupler, I would say that I have never made a confession such as you mention, nor do I know of any mechanical officer of any road who has.

Mr. D. HANKSWORTH, Superintendent of Motive Power of the Burlington & Missouri River Railroad in Nebraska, writes:

In answer to yours of the 8th, with reference to Mr. BLACKALL'S statement that a great many master car builders "frankly confess they were too hasty" in favoring the M. C. B. coupling, so far, my experience with the M. C. B. type of coupler has been very satisfactory, and I received orders a short time ago to fit up 100 additional stock cars with air-brakers and the M. C. B. type of couplers. I believe Mr. RHODES, Superintendent of Motive Power of the C. B. & Q., could give you some interesting figures regarding the Master Car Builders' coupler.

Taking the above letters altogther, and we shall doubtless receive further ones by later mails, they go far to indicate that the number of men who feel doubt that the M. C. B. standard was a judicious selection is at least not great.

FOR THE LONDON Watkin's Tower, 248 plans have been sent in from engineers and architects, 16 of these are from Americans and Canadians, and 16 from French and Germans. This is the tower that Sir. EDWARD WATKIN proposes to erect on the banks of the Thames.

PERSONAL.

Col. T. M. R. TALCOTT, who, since September, 1888, has been first Vice-President of the Richmond & Danville, with supervision and direction of traffic, has resigned.

Mr. GEORGE E. EVANS has been elected City Engineer of Lowell, Mass.

Mr. F. B. CLARKE, Traffic Manager of the Chicago, St. Paul, Minneapolis & Omaha, has resigned.

Mr. C. L. SPORE has been appointed Street Commissioner at Portland, Ore.

Vice-President C. C. HARVEY has been appointed Traffic Manager of the New Orleans & Texas Pacific Ry., and Traffic Manager JOHN C. GAULT has resigned.

Mr. I. G. RAWN has been made Superintendent of the Richmond, James River, and Peninsula Divisions of the Chesapeake & Ohio.

Mr. CHARLES L. MAYNE, Acting Superintendent of the Chicago & Atlantic, has been appointed Superintendent.

Mr. J. C. HOWELL has been appointed Superintendent of Water-Works at Athens, Ga., vice Mr. WM. MCKINNON resigned.

Mr. W. H. HOLCOMB, Vice-President of the Union Pacific, has also been elected Vice-President of the Denver, Texas & Fort Worth.

Mr. B. F. DICKSON has been appointed Superintendent of the St. Louis and Henderson division of the Louisville & Nashville R. R., vice Mr. DONALD ALLEN, resigned.

Mr. E. J. BLAKE has been appointed Chief Engineer of the Chicago, Burlington & Quincy, vice Mr. GEORGE C. SMITH, resigned to become Chief Engineer of Construction of the Western Railway of Uruguay.

Master Mechanic Z. J. FERGUSON, of the Mobile & Ohio shops at Jackson, Miss., has resigned that position to accept a similar one with the Cotton Belt Route at Pine Bluff, Ark. His successor is Mr. GEORGE MANUEL.

Mr. GEORGE BUTLER, Assistant Treasurer of the Atlantic & Pacific, died in Brooklyn, N. Y., last week. He was Treasurer of the road before it was merged into the St. Louis & San Francisco.

Mr. J. B. GARDINER, for 20 years Superintendent of the Providence Division of the New York, Providence & Boston, has been appointed Superintendent of the entire road.

Mr. GEORGE C. FERRIS, of Pittsburg, has been engaged by the County Commissioners, Cincinnati, O., to inspect the iron work for the several bridges in course of erection in Hamilton County by the Commissioners, including the Colerain Ave., Liberty St. viaduct, and four other iron bridges, for the sum of $2,000.

Mr. JAMES F. HOWE, Vice-President and Treasurer of the Wabash, has resigned the position of Treasurer to devote his entire time to the duties of Vice-President. Mr. F. L. O'LEARY, Assistant Treasurer, will succeed Mr. HOWE as Treasurer.

Mr. THORSTEN NORDENFELDT, Civil Engineer and manager of the Maxim Nordenfeldt Gun & Ammunition Co., has been declared a bankrupt. His liabilities amount to £50,000.

Mr. VERNON SMITH died at Ottawa, Ont., on Jan. 15. He was a civil engineer of much experience and had charge of several important engineering works abroad before his removal to Canada.

Mr. W. A. MCGINNIS, of Phœnix, Arizona, wishes us to correct the statement unintentionally made by us, that he is the Chief Engineer of a proposed railroad to run from Phœnix to a point on the Arizona & Prescott R. R. Mr. MCGINNIS states that he has nothing to do with the line.

Mr. J. P. ADAMS, Commissioner of City Works Brooklyn, N. Y., has appointed Mr. CHARLES W. SHIPMAN and Mr. JOHN E. HAMMOND Civil Engineers to assist on the water extension contracts. The appointments were made on the recommendation of Chief Engineer VAN BUREN. The former will receive a salary of $1,800 per annum and the latter $1,500.

Mr. WILLIS GAYLORD, for years a heavy manipulator of railway securities and organizer of railway corporations, committed suicide Jan. 2, in the county prison at Philadelphia, Pa. He was arrested November 18, in a suit for $30,000, brought by FREDERICK A. BABCOCK of New York, with whom GAYLORD had been interested in the negotiation of $515,000 of New Orleans, Baton Rouge & Vicksburg bonds. BABCOCK alleged fraud on GAYLORD'S part, while the latter asserted his ability to clear himself.

Mr. CHARLE MACDONALD, of the Union Bridge Co. of New York, was, on Jan. 14, elected President of the Engineers' Club of New York. For general information it may be stated that this club is a young but exceedingly flourishing social organization of men affiliated with engineering in all its branches. The club has a handsomely furnished house at No. 10 W. 29th St., New York. Mr. J. C. BAYLES was the President last year, and Mr. DAVID WILLIAMS, of 66 Duane St., New York is the Secretary.

Prof. JOHN H. C. COFFIN, U. S. N. (retired), died Jan. 9, at Washington, D. C. Prof. COFFIN was born at Wiscasset, Me., on Sept. 15, 1815. He was graduated from Bowdoin College, and in 1836 he was made Professor of Mathematics in the United States Navy. He served at sea and at the Naval Observatory, and prepared discussions of the work with the mural circle in the Washington Observatories in 1845-49. He was Professor of Mathematics or of Astronomy and Navigation from 1853 to 1865, and in 1866 took charge of the preparation of "The American Ephemeris and Nautical Almanac." Of this he was relieved on Sept. 15, 1877, when he was retired with the relative rank of commodore.

Gen. JAMES C. DUANE, late Chief of Engineers U. S. A., but now retired, and a member of the New Croton Aqueduct Commission, is adjudged eligible to the last-named position by Judges DANIELS and BARRETT of the Supreme Court. This is a decision in the case made by Corporation Counsel CLARK, who held that Gen. DUANE could not lawfully hold his position on the Aqueduct Commission and still draw pay as a retired arm officer. The two judges named held that the essence o office is duty; and that while a person may be retained in a military or governmental system as a legal appendage, either as an honor to the individual or for some special purpose of control, yet he cannot be said to hold an office in any genuine or vital sense when there is no duty attached to the situation and the officer is required to render no services.

Judge VAN BRUNT, the third justice, says that the United States statutes expressly declare that Gen. DUANE is a part of the army of the United States, and the Act under which the Aqueduct Commissioners are appointed says that they shall hold "no other office, civil or military." The intention of the Legislature appears to have been that an Aqueduct Commissioner should have no connection whatever with the army. Corporation Counsel CLARK said that an appeal would be taken. But the position taken by Counsel CLARK and Judge VAN BRUNT looks very like a "legal quibble."

Mr. WILLIAM STROUDLEY, late Locomotive Superintendent of the London, Brighton & South Coast Railway, England, died recently. He was famed in England for boldness and originality in locomotive design. He was early to recognize the value of the system of interchange ability of parts in engines of the same class, reducing the types to as few as possible; he used large leading wheels, and ran express engines with 6½ ft. coupled leading wheels; but he opposed the bogie truck and adhered to the six-wheel engine without bogie or radial axes. Mr. STROUDLEY was born in 1833 and started in life with few advantages. After serving his apprenticeship, he obtained a position, in 1854, as working foreman in charge of passenger engines on a division of the Great Northern Railway. He then had the post of Manager of the Cowlairs Works of the Edinburgh & Glasgow Railway from 1861 to 1865. He was locomotive and carriage Superintendent of the Highland Railway until 1870, when he entered upon his duties with the road first above mentioned. Mr. STROUDLEY was a Member Inst. C. E from Feb. 6, 1877.

CORRESPONDENCE.

Chilian Railway Matters.

SANTIAGO DE CHILI, Nov. 29, 1889

TO THE EDITOR OF ENGINEERING NEWS:

SIR: In your paper of Aug. 21, you state that the government railway gauge of Chili is 4 ft. 8½ ins. This is a mistake. The railways shown in time-table map are all 5 ft. 6 ins. The new lines now building, north from Calera, on the Valparaiso-Santiago line, are one metre The Copiapo and Iquique systems are 4 ft. 8½ ins., and there are mineral lines of 4 ft. 2 ins., 3 ft. 6 ins., 3 ft. and the Antofogasta Railway, now reaching Huanchaca, about 100 miles from Potosi, and to be extended to the same, and also north towards La Paz, is only 30 ins.

The broad, 5 ft 6 in. gauge for the government railways was fixed by the most distinguished and the ablest engineer we have had here, ALLAN CAMPBELL, Esq., now a resident of New York. Mr. CAMPBELL built the first railway in South America, the Copiapo, of 4 ft. 8 ins. gauge. When he took the Valparaiso & Santiago line in hand in 1850, locomotive builders did not then know that this gauge would give everything needed for heavy grades combined with sharp curves, and thought that for the successful operation of the mountain grades between this and Valparaiso, 5 ft. 6 ins. was needed. Experience has proved the reverse, but you must remember this was nearly forty years ago. I give this explanation so that you may understand why the gauge was selected.

It seems a mistake for the government engineers to have selected one metre for the lines north, bearing in mind there are nearly 400 kilometres of 3 ft. 6 ins. (1.06 metres).

I send by to-day's mail two pamphlets and a time table of the government roads. The first gives an account and maps of the Northern and Southern Trans-Andine railways. Of the two routes shown in the first, the Argentine Congress preferred Cawanga & Co., though the Palma route has far better grades and other advantages, and they have given them a guarantee of 6 per cent. A bill is now before the Chilian Congress for a similar guarantee on the Chilian division. This, as well as Clark's Mendoza line, is one metre, while Bustamante & Co.'s line is standard, 5 ft. 6 ins. Clark's plans for the Chili division have just been approved by the Board of Public Works, and when published I will take care to send you a copy. We have grades of 8 per cent., and no end of tunnels, and will use the Abt system of engines.

The Bustamante line was to have started from the junction with the Bahia Blanca line. In order to open up a new zone of country, the Government obliged them to start from Buenos Ayres, and thus parallel the Bahia Blanca line, though it is about fifty miles distant. Their grades are fair, hardly reaching 3 per cent., while the summit is under 6,000 ft. They commenced construction last week.

I should explain to you that the north of Chili is sparsely settled. The central valley ends about forty miles north from Santiago, and frequent spurs come from the main Cordillera, making construction costly and difficult. In the province of Atacama, the central valley appears again, but is a desert. This Government intends to build a railway from Calera to Iquique, and thus secure a railway connection from north to south, with one break of gauge at Calera.

C.

Notes and Queries.

Mr. B. R. WHITNEY, of Kansas City, Mo., writes:

I have for many years used a formula for the ordinate from any point of a chord, which has been so useful to me that I think it worthy of publication. It is this:

Divide the product of the two parts of the chord by the diameter of the circle. Thus, for the ordinate at a point 35 ft. from the end of a 100-ft. chord of a 4° curve

$$c = \frac{35 \times 65}{2865}$$

This is not mathematically exact, the error increasing with the length of the chord. But ordinates for very long chords are not needed except in location work when every engineer and instrument man has a field-book. It is practically correct for any chord subtending an angle of 20° and is correct to two places of decimals for a 100-ft. chord of any railroad curve.

The formula is easily carried in the memory and is applicable to all cases that will come up in the course of construction work, when the engineer usually finds himself without a table-book.

F. C. B., Kalamazoo, Mich., asks for information regarding a machine, supposed to have been invented in Leicester, England, for treating the *Peta* fibre. This machine is said to have been awarded a prize by the East Indian Government. Our correspondent wants to know if it is yet in successful operation anywhere, and where it can be purchased. We must refer him to our readers.

J. D. CRUSE, room 406 Exchange Building, Kansas City, Mo., wishes to know from some of the older members of the engineering profession, if possible, of the whereabouts of JOHN CRUSE, C. E. He graduated from Trinity University, Dublin; was employed in London under BRUNEL. Then came to America and was employed on the Erie Canal and Michigan Central R. R.; the Terre Haute & Richmond R. R., under CHAUNCEY ROSE; the Ohio & Mississippi R. R., in the time of Page & Bacon; and the H. & St. Joseph R. R., under Maj. BUCKLIN as Chief Engineer. He was last heard from in 1856, as surveying town sites along this latter road in Missouri. Any clue as to the ultimate fate or whereabouts of JOHN CRUSE will be much appreciated by the applicant.

A. M., of Toronto, asks for the size of the largest tunnel constructed of iron, after the manner of the Detroit River Tunnel, of which we have any knowledge. The best tunnel and the largest in size, made of cast-iron, is, we believe, the new tunnel just completed under the river Thames in London. There are two parallel tunnels each 10 ft. 6 ins. in inside diameter. The tunnels under the Hudson River have dimensions of 21 by 23 ft. each; but they are lined only with wrought-iron flanged plates as a protective measure until the permanent brick lining is put in place

The Thomson Electric Welding Process.

A paper was recently read by Mr. W. C. FISH, of Boston, Mass., before the British Iron and Steel Institute, giving an interesting description of this new process of welding.

The following is the manner in which the invention was first suggested to Prof. Thomson:

Several years ago Professor ELIHU THOMSON, of Lynn, Mass., had occasion to deliver a lecture before the Franklin Institute in Philadelphia. In preparing certain electrical apparatus for this lecture, Professor THOMSON had the questionable misfortune of short-circuiting an induction coil, which, quite naturally, resulted in the fusion of the copper wire of the coil. If fusion could thus be produced accidentally, why, if economical and practical, should it not be intentionally produced and applied to the treatment of metals? And from this accident, probably, came the germ of thought which, to-day, extending and developing itself, gives to the arts the process of electric welding.

The requisites of an electric welding plant, generally speaking, are:—

1. Apparatus for the production of a suitable current, with means for quickly and exactly regulating the current. The current for welding may be either continuous or alternating in direction. The employment of the alternating current offers certain electrical advantages in the production of sufficient current strength and in the transmission of energy to a distance from the source of supply, and is that usually employed.

2. Clamps which shall hold the pieces to be welded in correct relative position, and which shall be relatively moveable in such a manner that the pieces may be forced together when heated.

3. A method for permitting the welding current to enter the pieces without loss of energy. This is usually accomplished by causing the movable clamps which hold the pieces to become a portion of the circuit, and, from their ample contact, both with the pieces and the remainder of the circuit, to offer no appreciable resistance to the current flow.

4. A manner of obtaining a suitable pressure, which will force the pieces together during the operation of welding.

The last three considerations relate chiefly to simple mechanical details, and are easily obtained.

With our present knowledge relating to the transfer of heat energy into electric energy, a welding current, that is, one of great volume, is best produced by the three following methods:—

1. The employment of secondary or storage batteries. This method is scarcely comparable with the two which follow, though it might be used to advantage in certain special cases and particularly where the existing steam plant is of insufficient power. In this case energy could be stored in the batteries and drawn upon when sufficient is accumulated.

2. A dynamo of extremely low armature resistance furnishes current directly to the weld. The weld, however, must be near to the dynamo, else, unless cumbersome and expensive leads be employed, the loss of energy in the conduction of the current would be excessive. In practice, the clamps carrying the pieces to be welded are placed directly above the dynamo on a suitable table. This system is simple and economical, but necessitates the carrying of the "work" to the dynamo.

3. The employment of an alternating current dynamo and a transformer. The function of the transformer is to transform, through the medium of a magnetic circuit, the comparatively high electric pressure and small current produced by the dynamo into a current of comparatively great volume but of low pressure, which current shall be applied to the weld. Since, by this system, we can carry the small current produced by the dynamo to any desired spot with little loss of energy, and through conductors of small cross-sectional area, and there obtain a current of the desired magnitude, this method is the most flexible and useful of the three.

With the latter system the welding may be done at a distance of a mile or more from the dynamo if need be. The fluxes employed in the welding process are similar to those in common use for brazing and welding. Besides the ordinary method of determining the progress of the weld by noting the color of the metal due to the heat, a skilled operator is also guided by the resistance to compression which the pieces exert when subjected to pressure.

The burr which forms at the point of junction can be reduced when desired by hammering, in the case of metals like iron and steel which are not hot-short. This hammering, if carefully done, is often advantageous with the harder grades of cast steel on account of its refining tendency. With wrought iron, its effect is to restore the fibrous structure.

Some metals, such as copper and brass, weld at a temperature nearly equal to that of fusion, and have also a very limited range of temperature at which the weld can be made. In welding metals of this nature, the tension of a spring may be nicely adjusted to produce the necessary pressure, to give the desired approach of the pieces at exactly the proper temperature, and this done, to automatically shut off the current from the weld.

By the simultaneous application of heat and pressure the weld is effected at a temperature slightly less than that necessary when heat alone is used.

The following figures, taken at random, give a few results of tests made on the tensile strength of welds:—

Material	*Breaking strength lbs. per sq. in.*	*Position of Fracture*
Wrought iron	53,110	1.7 ins. from weld
Cast steel	81,000	At weld
Bessemer steel.....	59,584	"
Copper (hard drawn)	31,830	"
"	32,480	¾ ins. from weld
Brass.....	40,820	At weld
"	47,730	¾ ins. from weld
Steel and German silver.....	40,410	At weld
Cast-steel and wrought iron	52,130	3 ins. from weld in the iron
Brass and wrought iron.....	33,550	At weld

Generally speaking, in the welding of the ordinary commercial metals, a tensile strength, at the weld, of 90 per cent. of the strength of the unwelded metal is obtainable.

The time of welding varies with the conditions under which the weld is made. The quicker the weld is made, however, the more economical it is, since there is less time for the loss of energy through the conduction and radiation of heat.

Determinations of the power and time required for welding give somewhat empirical results, owing to the indeterminable effects of conduction and radiation of heat, and other factors more or less changeable with different sizes and metals. For the same reasons, no general statement can be given of the required current density per square inch.

For many tests upon the time and current required for welding iron of varying sizes, mention may be made of the following approximate figures, which are also closely applicable to steel;—

Ampères per sq. in. required.	*Time of Weld.*	*Product.*
9,500	40 seconds	380,000
12,000	30 "	360,000
15,000	20 "	300,000

The power required per square inch of material in the last case, for example, the material being round iron ½ in. in diameter, is the product of 15,000 and 1.16 (the number of units of electrical pressure or volts in the welding circuit), giving 17,400 volt-ampères, the equivalent of 23.2 H. P. Assuming the efficiency of the electrical apparatus to be 85 per cent., we obtain 27.3 H. P. as that to be applied to the belt of the dynamo. The actual power required for the half-inch bar itself is, if we keep our same imagined efficiency of electrical apparatus, 5.36 H. P.

A rough summation of the claimed advantages of this process, and of the different classes of applications, may be of interest.

1. The ability to unite most commercial and precious metals and alloys; also several combinations of different metals and alloys. Most of these substances have hitherto been unweldable by other processes, chiefly owing to the inability to nicely regulate the supply of heat to the weld, and to the impurities existing in the forge fire and other commercial sources of heat.

2. The simple commercial advantages of economy, rapidity of work, etc. The consumption of energy takes place only during the brief period of the operation. Moreover, the process can be used in those places where a forge fire would be a source of annoyance or danger.

3. The nicety and certainty of the work is obtained chiefly through the cleanliness of the heat employed, and also because the pieces to be welded are held in correct relative position during the entire operation; thereby many irregular shapes can be welded, which, to the smith, offer inconveniences in manipulation.

The localization of the heat, beside the economical advantage, prevents any annealing action except in the immediate vicinity of the weld.

4. The operator of the welding machine needs no knowledge of electrical laws, nor need skilled labor be employed. Also, since the welding current is of extremely low pressure, there is absolutely none of the danger which many, on seeing the tremendous heating effect of the current, have supposed to exist.

The following is an incomplete mention of a few of the various applications which exist in many of the mechanical arts:

1. The welding of solid material. This general statement includes all wire welding, whether the construction of long lengths in the process of wire manufacture, or the making and separation of joints in the various mechanical and electrical industries. In this connection may be mentioned the welding of wire ropes and cables. That this is possible without considerable loss in the continuity of the individual wires composing the cable may be surprising, but in reality a tensile strength at the eld of upwards of 80 per cent. of that of the cable itself is obtainable, while the flexibility is but little impaired. A solid collar placed around the weld prevents deformation of the cable during the operation.

Elements of Weather in the United States of most Interest to Engineers, for the month of December, 1889.

STATIONS.	Temperature. Degrees Fah.				Wind velocity. Miles per hour.			Precipitation. Rain and melted snow. Inches.		
	Average	Max.	Min.	Range.	Average.	Max.	Direction at time of Max. Vel.	Total.	Heaviest in 24 hours.	No. rainy days
Northern Cities.										
Northfield, Vt	26.2	55	—12	67	10.2	48	NW	2.61	.61	14
Portland, Me	32.0	60	4	56	18.3	40	S	4.96	2.22	13
New York City	41.4	65	13	52	11.7	48	SW	1.81	.65	13
Pittsburg, Pa	45.6	67	22	45	5.2	34	NW	3.07	.87	16
Chicago, Ill	40.6	64	15	49	10.3	36	NW	1.90	.95	10
Omaha, Neb	39.6	68	10	58	8.7	42	NW	.50	.41	5
St. Paul, Minn	28.6	47	—4	51	7.5	28	N	1.32	.66	9
Duluth, Minn	25.6	43	—6	49	8.0	39	NW	1.77	.50	15
Bismarck, Dak	16.0	42	—6	48	7.7	40	NW	.69	.65	2
Average	32.8	56.8	4.0	52.8	8.6	39.4		2.07	0.84	10.8
Southern Cities.										
Washington City	46.0	72	22	50	6.0	36	N & NW	.19	.05	7
Louisville, Ky	51.4	70	24	46	6.2	32	W	1.74	.88	15
St. Louis, Mo	49.8	73	20	53	10.2	39	W	1.03	.62	6
Savannah, Ga	59.7	77	32	45	5.6	22	W	Trace	Trace	0
Leavenworth, Kan	45.5	73	11	62	6.3	36	S	.08	.02	5
Jacksonville, Fla	62.0	80	35	45	3.2	22	N	Trace	Trace	0
Chattanooga, Tenn	57.2	73	25	48	5.1	22	SW	.44	.31	7
New Orleans, La	64.3	80	39	41	6.5	23	SE	.67	.65	2
Memphis, Tenn	60.2	76	28	48	6.9	27	SE	.46	.38	4
Palestine, Tex	64.3	80	31	49	7.2	26	S	.39	.30	4
Average	56.0	75.4	26.7	48.7	6.3	28.5		0.50	.32	5
Western Cities.										
Helena, Mont	22.6	47	—9	56	3.2	24	SW	.18	.13	4
Port Angeles, Wash			Not re-		yet re-		ceived.			
San Francisco, Cal	51.3	63	40	23	7.7	32	SE	13.81	1.46	24
Salt Lake City, Utah	39.6	57	11	46	6.1	30	E	4.37	.82	23
Denver, Col	40.5	66	4	62	6.7	38	NW	.30	.22	3
Yuma, Ariz	58.0	73	38	35	4.4	33	N	2.43	1.01	9
Santa Fé, N. Mex	29.7	59	10	49	5.8	36	SW	.26	.10	9
Average	35.3	60.8	15.7	45.1	5.6	32.2		3.56	0.62	12

This class of work also includes the welding of all sorts of solid bars, angle iron, etc., as well as the lengthening of connecting rods, rails, shafting, and construction material in general.

Another important application is the welding of tires, hoops, bands, and similar endless work. In work of this nature, it might be expected, at first thought, that the greater portion of the current would flow through that solid and continuous branch of the ring which did not contain the point of weld, since the continuity of the metal is somewhat broken at this point, and the electrical resistance is increased. Nevertheless, either by suitable clamping arrangements, or by electrical devices, the current may be forced to flow almost exclusively through the proper path.

In this category of solid bar welding would be included the welding of links of various sizes and metals, both commercial and precious. The ordinary form of link is easiest made by placing two U-shaped pieces end to end, the two welds occurring in each link being simultaneously made.

2. Pipe work, including the welding and brazing of various metal pipes, either into long lengths and coils, or even, as is now being done in America, for the utilization of what would otherwise be "scrap." By proper shaping of the pipe ends previous to the welding, the cross-section of the pipe at the weld will remain practically unchanged. One requirement for pipe welding is that the entrance of the current into the pipe should take place with sufficient uniformity around the circumference.

3. General construction and repair work. The application to tool-making and repairing might be particularly mentioned, and the substitution, when desirable, of soft grades of steel and iron in place of harder and more expensive cast steel. When two different grades of steel are united, the higher carbonized metal apparently gives up some of its carbon, at the point of weld, to the less carbonized metal, and thereby tends to produce uniform graduations of the metal from one piece to the other. In welding two alloys, such as brass and German silver, there seems to be simply a mechanical mixture of the two, but no tendency to form a third alloy.

4. The application of electric heating for shaping, forging, brazing, local tempering, and annealing exists in many industries; for example, the heating of pieces to be pressed into shape while hot in the clamps, straightening bent shafting and bars, or the formation of local and accurate bends.

It may be of interest to mention the possibility of electric riveting, which has already been accomplished on a small scale, and is found to be a perfectly practical process. The cold rivet is placed in the rivet-hole and electrically heated to the proper temperature. The heating of a half-inch rivet, of 2 or 3 ins. in length, would occupy probably about 20 or 30 seconds. As the plate itself becomes somewhat heated in the immediate vicinity of the rivet-hole, there is a partial weld made between the rivet-head and the plate.

Extracts from the Interstate Commerce Commission's Report.

In our last issue we gave a brief summary of the matter in this report and a lengthy abstract of the portion referring to the use of safety appliances on railways. The following extracts relate to some other interesting matters discussed by the Commission:

FREE PASSES AND FREE TRANSPORTATION.

Twenty-four companies operating in the New England and Middle States furnished the Commission on request with lists of the persons to whom free transportation was given, with the reasons therefor. By these returns the largest class of interstate passes were "complimentary." Next in number were passes to steamship lines and transfer companies, United States, State and Municipal officers, palace-car companies, and for advertising. Of State passes, the largest numbers were issued to members of legislatures and drovers, with "complimentaries" next.

The Commission condemns the "deadhead" system as deserving of no favor, and implies that, while the investigation is not concluded, the free passes which have been given since the passage of the Act are practically all in violation of the law. It is recommended, however, that an amendment be made to Section 22 of the Act, so that the free transportation of persons injured in railway accidents and the physicians and nurses for their attendance may be lawful, and that the transportation, free or at reduced rates, of actual resident members of the families of employés be also permitted.

The closely related evil of selling passenger tickets at reduced rates the Commission believes to be a pernicious one; and attention is called to a former recommendation by the Commission that the law be so amended as to define what shall be considered excursion and commutation tickets and to so restrict their issue as to prevent abuses.

CAR MILEAGE.

The Commission's investigation last May of the practice of twenty-six Western companies regarding car mileage disclosed that the rates are as follows: For Pullman palace cars or for ordinary passenger cars exchanged with other companies, 3 cents per mile; for baggage, mail, and express cars exchanged with other companies 1¼ cents per mile; for Pullman tourist sleepers and for refrigerator cars on most roads, 1 cent per mile. For all other cars, ¾ of a cent per mile.

The Commission shows how an investment by a private company in refrigerator cars may pay a profit of 50 per cent. or more per annum. While the evidence did not prove that rebates to shippers owning these cars were paid, it was strongly hinted that such might be the fact.

The Commission gives an abstract of the balance sheet of the Pullman company, showing that its net profits for the year ending July 31, 1888, were 20 per cent. on the capital stock. It is intimated that a reduction in the mileage rates for these cars would be only just to railway stockholders. The general conclusion is as follows:

Cars for the various kinds of business done by a carrier should be owned by the carrier itself and furnished to all alike, or, if owned by the shipper, only such reasonable allowance for their use should be made as to permit no advantage to the private owner of cars who is also a shipper, nor afford a margin for paying rebates to other shippers.

FREE CARTAGE.

In June last 585 railways were asked for information concerning the free cartage delivery of goods. By the answers it appeared that only 65 railways allow free cartage or equalize cartage allowances, and that no company has free cartage at all its stations, but as a rule only at a few.

COMPETITION BY CANADIAN CARRIERS.

This is a factor of importance in the transportation interests of the United States, and it is not casual or temporary, but permanent. It has been aided in its growth by State and National legislation in this country and by the investment of American capital.

The existence and character of Canadian competition are therefore largely due to friendly coöperation on the part of our own country, inspired as it would seem by a policy of business independent of national boundary lines, and regardless of rivalry by the subjects of a foreign jurisdiction. What is called Canadian competition, therefore, is the common use by our own citizens of Canadian carriers for business that might be done by our own carriers, and induced solely by commercial considerations.

. . . . . .

It is estimated that fully one-third of the through business of the Canadian Pacific to and from the Pacific coast consists of traffic furnished from the United States. The west-bound business going over the Canadian lines originates at various places in the New England and Middle States, and at the Northwest. These lines, therefore, compete for traffic moving in both directions across the continent, or across sections of it.

The Canadian lines carry United States traffic at lower rates than the American lines. By traffic arrangement between the companies, the Canadian lines are allowed a differential. The reasons for these lower rates are, first of all, the necessities of the situation. The Canadian lines have to carry at lower rates to get the business. Expenses of operation of many American roads are believed to exceed those of their Canadian competitors. Canadian roads may fix their local rates without regard to the through rates. American roads cannot do this on account of the Interstate law.

There is no doubt, however, that considerable portions of the country, including especially northern and central New England and large portions of the Northwest, are considerably benefited by the lower rates of the Canadian carriers.

RELATIONS OF LAKE AND RAIL TRANSPORTATION.

When Congress was given power to regulate commerce among the States, railroads had no existence. To whatever extent the regulation so provided for was intended to include transportation or transportation charges, it must have had special reference to the then existing transportation methods, which were mainly by lake, river, or coastwise carriers.

The regulation for which provision is made in the Act to regulate commerce does not apply to commerce as it was conducted when the power to regulate was conferred. The Act leaves carriers engaged in transportation wholly by water independent of regulation.

The exemption of so considerable a part of transportation from the operations of the law is a serious hindrance to the regulation of that which the Act includes. The construction and maintenance of the way or track is a principal item in the cost of railway transportation, while the permanent way over navigable waters is free from expense or is maintained at public cost. In water transportation, carriers provide only the vessel or vehicle of carriage. There is, therefore, a wide difference in the cost of rail and boat service, and water transportation charges can be very much the lower and be remunerative.

Carriers by water are not required to publish rates, and are under no restrictions as to rebates, discriminations, or as to charges proportioned to distance. No stability is required in their charges, which may fluctuate as often as the exigencies of business rivalries dictate or the necessities for traffic render expedient. Whenever rail and water transportation are in direct competition, a reduction of rail rates to meet the water charges is regarded as essential to secure any part of the traffic. Independent or unregulated water transportation in parts of the country is so influential in many ways as to be the cause of demoralization in rail rates as well as to afford the basis of inequalities between localities, having the appearance of unjust preference.

These are some of the effects of unregulated water transportation. Its usefulness must not be in the least impaired, but it is both expedient and just that it should be so far regulated as to prevent its demoralization of other transportation. This requires carriers by lake, river, and coastwise to publish and maintain tariffs as do carriers by rail, and be alike subject to the general provisions of the Act.

RAIL TRANSPORTATION NOT SUBJECT TO THE LAW.

The Constitution of the United States, provides that the Congress shall have power "to regulate commerce with foreign nations, and among the several States, and with the Indian tribes." No question, therefore, can arise of the authority of Congress to make its legislation as broad as the power itself. In undertaking the regulation of commerce by rail, legislators, both State and National, have been dealing with a subject that in many respects was so different from any other with which they have occasion to deal that the ordinary rules and analogies could not possibly be applied to the full extent. Every step taken has been persistently opposed by the interests to be affected; and it has been universally felt that the legislation hitherto adopted could not in all respects be final, but has been rather initial, and though important and in the right direction, constitutes only steps towards an ultimate solution of what is commonly spoken of as the "railroad problem." No one who has given proper thought to the subject now deems that problem fully solved; every one who has studied it candidly sees that further action in the line of the existing statute is necessary for the purposes of a complete solution.

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The railroads of the country do not constitute one separate national system and separate State and Territorial systems operating independently of each other. There are a great many railroads in the country that do not extend beyond the limits of a single State, but there are very few of them that are not, by affiliation and at least partial control, connected with roads that are interstate. It is doubtful if there is a single railroad in the country that does not to some extent participate in interstate traffic, and which, if left to be a law to itself, or subjected to laws which differ from the Act to regulate commerce, may not be a disturbing element in the enforcement of that Act. There is no such thing as a complete and harmonious regulation of interstate commerce by rail when a part of the carriers by rail are governed by one set of laws, and other parts are left to the regulation of laws which are materially different. Still less can there be complete and harmonious regulation when, even upon interstate roads, there is regulation of a part of the traffic by one set of laws and another part by another materially different. An interstate road takes little or no notice of State lines in the management of its business.

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The State regulation, unless the State law should be substantially identical with the Federal law to regulate commerce in all essential points, would, of necessity, if enforced, constitute to some extent a regulation of the interstate traffic. State rates must often necessarily affect interstate rates. State regulation in regard to safety appliances might, if enforced, constitute a regulation of interstate traffic to some extent, unless the railroads were required to separate in their trains all State from interstate traffic; but this could not be done without greatly increasing the present cost of rail transportation.

CONSOLIDATION.—ABSORPTION OF WEAKER LINES BY THE STRONGER.

The tendency in recent years towards the aggregation and combination of capital invested in various of the larger business pursuits has been so marked—such aggregations are so subject to misuse, and when misused are so potent for mischief—that every new indication of the growth of this tendency leaves the public less free from apprehension.

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The fact seems to be that every railroad combination in the direction of unity of interest or unity of control provokes such suspicion as to warrant, if it does not require, explanation.

The tendency to consolidation of railroads and to the absorption of the weaker by the stronger lines has been sometimes ascribed to the Act to regulate commerce, or some of its provisions. It has been so ascribed by those of such experience as to entitle their opinions to consideration.

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With an average annual railroad investment approximating $400,000,000, and a corresponding increased railroad mileage, there are each year more roads for consolidation, increased opportunities for absorption, new and greater inducements for combination. Yet the proportion of combinations effected was greater before than after the Act. Considered separately for the period of nine years since the last census, the number of roads merged annually in the seven years before the Act was nearly double the number annually merged in the two years thereafter. The combinations for these nine years, and how effected, appear in the following statement, which, with the subsequent statements, is taken from the best obtainable data:

CONSOLIDATIONS, ETC., TO DEC. 31, 1888, OF ROADS THAT WERE OPERATING COMPANIES ON JUNE 30, 1880.

How Acquired.	1880	1881	1882	1883	1884	1885	1886	1887	1888
Consolidated, absorbed, and merged	53	53	11	9	7	5	9	9	7
Controlled, leased, and operated	60	28	40	22	12	23	12	15	21
Purchased	10	8	3	5	1	2	2	2	4
Total	115	89	54	36	20	30	23	26	32
Reorganizations and changes in name	7	7	4	3	5	5	12	11	3

RECAPITULATION.

	Total.	*Average per year.*
For 9 years	425	47
For 7 years preceding 1887	367	52
For 2 years (1887 and 1888)	58	29
For 3 years (1880, 1881, and 1882)	258	86
For 3 years (1883, 1884, and 1885)	86	28
For 3 years (1886, 1887, and 1888)	81	27

INSURANCE FUNDS AND THE RELATIONS OF CORPORATIONS TO THEIR EMPLOYES.

A comprehensive view of the relations which exist between the railway corporations and their employés is no less interesting than important; and it seemed desirable to the Commission that facts should be gathered showing not only what provisions were made in the nature of insurance for the persons and families of employés by organization among themselves, but also to what extent their employers have made provisions for funds to accomplish a like purpose. For this purpose circulars were addressed to the heads of the most important orders now in existence composed of railroad employés, and also to officials of 85 of the leading railway companies.

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On the part of the labor organizations it is made to appear that there has been a very general adoption of something in the nature of a mutual insurance system on the assessment plan, whereby in case of injury or disability from sickness the beneficiary draws a stated weekly allowance, or, if death ensues, his family is made sure of a sum that will at least suffice to remove immediate want. There is every evidence that this insurance feature has the hearty support of the several brotherhoods or orders, and is greatly to the advantage of the members. The only questions made related to the methods to be employed and the persons to whom control should be given. Funds devoted to this purpose seem, so far as may be judged from the reports, to have been well managed.

In the matter of rules governing apprenticeship, no fixed system seems to prevail, nor any desire to interfere with company regulations.

As to promotions, the prevailing sentiment favors making length of service the determining factor where other things are equal, and the bringing of men from the outside to fill positions is spoken of as a cause of dissatisfaction in one of the brotherhoods. Those who speak for the principal orders are unanimous in expressing their belief in the good results attending such associations, not only to those who are thus banded together but to the employing companies. It is insisted that a more trustworthy and efficient class of men is secured thereby. One of the organizations in particular makes sobriety a condition of membership, and deviation therefrom a cause for expulsion. Harmonious relations between employers and employés are noticed in several communications

The inquiries addressed to the railroad companies are quite fully answered and embody much valuable information. Of the eight answering, twelve appear to have instituted insurance funds in the interests of their men; five others have hospital funds; five have benefit associations, supported wholly by employés; one contributes annually $500 for a like purpose, and one contemplates starting an insurance department at an early day. Fifty per cent. of the lines heard from furnish eating and lodging houses to their employés needing them. Twenty of them provide technical education to a greater or less extent, but in all cases where no regular technical training is supplied as such training, the apprenticeship system prevails, or men are selected who have proved their competency by actual service. It is plain, from the responses obtained from both classes, that with the growth of closer relations between employees and the corporations, not only are the interests of both greatly promoted, but the public is assured of better and more efficient transportation service.

Freight Transfer Bridge.

(WITH INSET)

In the general designing of freight transfer bridges, or those intended to span the distance between the float and the shore, two of the principal considerations, and one about which engineers vary most decidedly in their opinions, are whether to build the structure so rigidly, both as regards trusses and floor system, as to prevent distortion from unequal loading, or to so build that the bridge may accommodate itself, or warp, so to speak, when subjected to a great load upon either track. It is very evident that the bridge as ordinarily constructed, and the outer end of which rests upon a pontoon, is subjected to great strain when, as is customary, an engine is run upon one side in order to bring that side to the level of a loaded float, this being of course necessary in every case. Further, after having united the depressed corner of the bridge to the float by means of the usual toggles, it then becomes necessary to run the engine upon the other track to serve as a dead weight in order to bring that corner down to a level with the float. It is very apparent that by this operation the bridge is subjected to strains which are decidedly unusual in any other service of this class of structure, and that the diagonal forces here exerted by the dead weight of the engine upon one corner and the two pivots at the shore end of the bridge form problems of calculation which are difficult to meet.

Another and a very serious objection to this method of construction is due to the fact that much valuable time is consumed in preparing the bridge, or bringing it to such a position that it can be used as a passage uniting the shore and float. This fault is perhaps of greater magnitude in this locality than elsewhere, since the time occupied in crossing the river is already considerable.

Therefore, the question has arisen as to which is the better policy—to attempt to build a rigid bridge, or one having such a degree of elasticity that it will accommodate itself to unequal loading. Recent practice appears to favor the rigid structure. One of the latest examples of this type is that built at Jersey City, by the Erie Railroad Company for its freight business, which consists of two unusually massive pony trusses united by a heavy floor system, the outer end of course being provided with the usual gallows frame for raising the bridge to accommodate the tides and provide for too little buoyancy in the pontoon.

But there are also along the shore old forms of wooden truss bridges, which, to a certain extent, yield to unequal loading, and for years have performed the service in the most satisfactory manner. In some of these the trusses, when looked at from the end, present a serpentine appearance and when subjected to unequal loading, they yield to a remarkable extent. These bridges are now in everyday use, as they have been for years, and are admirable examples of the elastic type.

The bridge of which full drawings are herewith presented was built several months since at Harsimus Cove, Jersey City, by the Pennsylvania Railroad Company. In one sense it goes back to the original idea in ferry bridges. This old type consisted simply of a floor hinged at the shore and provided at the outer end with a gallows frame and chains and hand-wheel gearing, and counterbalanced by means of an arm and weight similar to the old-style swinging bucket for wells, the outer end of this arm carrying a weight nearly sufficient to counterbalance the weight of the bridge. In this case, of course, the hand-wheel was only used

to lift the surplus weight of the bridge over that placed in the outer ends of the arms. The bridge we herewith illustrate is hinged at its shore end, and is supported wholly at its outer end by means of suitable chains and rods passing over the gallows frame, the motive power for operating the free end of the bridge being provided by a steam engine, and the pontoon being entirely dispensed with. In this case, also, the free end is counterbalanced, the weight being attached to chains passing over pulleys suitably arranged on top of the gallows frame.

But an innovation is here introduced by means of which the free end of the bridge need not be lowered or raised at every condition of the tide. By its aid the bridge is only raised three or four times during the rise or fall of the tide, the distance traveled being in each case about 12 inches. In order to provide for the difference in level of the ends of the bridge and the load, or unloading float, there is an apron which in every respect answers the purpose of the main bridge, and which it resembles in the work it performs, the only difference being its smaller size. This apron is hinged to the end of the main bridge, and is provided at the outer end with a friction gearing by which the movement of its free end is controlled The friction of this gearing is sufficient to maintain the apron in position when it is unsupported by the float, and yet it is not sufficient to prevent the free movement of the float, that is, the rise or fall of the float due to unloading or loading. This apron is also counterbalanced to such an extent that it can be easily operated by two men, disposed one at each side. In practice it is generally kept raised a little above the float level, and then lowered to engagement with the float when the latter has been brought to position.

One decided advantage resulting from this construction arises from the fact that ice has no influence whatever upon the operations of the bridge. It is well-known that from this cause bridges supported upon pontoons give much trouble in the winter owing to the ice packing in under the pontoon. In this case the entire space beneath the bridge being perfectly free, there is no chance for the accumulation of ice; and a decided annoyance, and in some instances a hindrance to the expeditious handling of the bridge, is done away with.

The main bridge has a length over all of 71 ft. 6 ins., the apron being 25 ft. long. The trusses are 13 ft. apart in the clear and are 24½ ins. wide, making the extreme width of the bridge 19 ft. 1½ ins. The trusses are 10 ft. 1 in. high. The dimensions of the several members and the material of which they are made are shown upon the drawings. The floor beams which are placed 2½ ft. centres to centres, are 8x15 ins., yellow pine. The diagonal braces are 4x12, yellow pine. The apron is formed of 6x14, yellow pine, timbers extending longitudinally, the truss rods being 2 ins. in diameter and arranged as shown in the side elevation.

The free end of the main bridge is carried by six 1½ in. steel wire ropes, which, as will be seen in the end view, are led over suitable sheves 4 ft. in diameter, arranged on top of the gallows frame and leading to each side of the end of the bridge, where they are attached to suitable cast-iron weights, which serve to counterbalance the bridge. Connected with each outer end of the trusses are two bars, 1¼x4 ins. each, which extend up and unite with the lower end of a vertically placed screw, made of steel, of a diameter of 4½ ins. and pitch of 1 in. The wire ropes mentioned above have nothing whatever to do with operating the bridge, they being simply intended to carry the counterbalancing weights. The bars just mentioned are intended to support the overplus weight of the bridge, and also to govern its rise and fall. On the top of the gallows frame truss is a worm wheel, made of gun metal, having a pitch diameter of 16¼ ins., and which is threaded to engage with the lifting screws. These worms are operated by a 3-in. shaft extending across and parallel with the top cord of the frame, mounted in suitable cast-iron boxes, and provided at each end with a bevelled gear, with which meshes a similar gear on a 2-in. wrought-iron vertical shaft which extends down to the platform, where it is connected by means of bevelled gears with the operating hand wheel. It is evident that by turning this wheel in one direction or the other the lifting screws may be raised or lowered, and with them the free end of the bridge. An engine has been introduced, as by its aid the work can be performed more rapidly. The free end of the apron is provided with a similar system for lifting, it having also the friction gearing to control its motion as described before. It will be noticed from the front elevation that the bridge is really built double, two precisely similar in every respect being placed side by side. Two tracks are put in each space between the trusses, this being done to accommodate floats of different widths. From the general outline we have given above, together with the complete detail drawings presented, we judge a very fair idea of the construction and operation of the bridge can be obtained.

RAILWAYS.

EAST OF CHICAGO.—Existing Roads.

Pennsylvania.—Nearly all of the contracts have been let for the double-track cut-off from Morrisville to Morristown, Pa., a distance of 33 miles. The contracts have been let as follows: to John Shields, of Flemington, N. J. sections 1, 2, 3, and 4, to Keller & Crossan, of Lancaster, Pa., sections 6, 7, 8, 9, and 10, to Chas. McFadden, of Philadelphia. sections 16, 17, 18, and 19, to Mr. Caran, sections 22 and 23, to John Dyer, of Morristown, Pa., sections 24 and 25, to John and Edward Kelly, of Philadelphia. sections 26 and 27, to Bringlinger & Neering, sections, 28, 29, and 30, and to Ryan & McDonald, of Waterloo, N. Y., sections 31, 32, and 33. including a large bridge across the Schuylkill River at Morristown, Pa. The contract of Chas. McFadden comprises some very heavy work. The road is being built to furnish a short line for the through freight traffic from the west to New York. Negotiations are now in progress with the Philadelphia & Reading R. R. Co. for the line from Morristown to Downington, Pa., and when these are completed the company will have almost a straight line from Downington to Trenton, N. J., for the western freight all of which now passes through Philadelphia. It is announced that this company is negotiating for the purchase of the American Midland R. R. now in operation between Findlay and Ottawa, O., with the object of making it a link in a new short line to Chicago. The plan is to build a new line from Findlay to Crestline or Upper Sandusky, O., and to complete the partially graded line of the American Midland to Ft. Wayne, Ind., thus obtaining a short line across Northern Ohio.

Valley (Ohio).—This railway running from Cleveland to Valley Junction, O., 75 miles, has been purchased by the Baltimore & Ohio R. R. Co. It is stated that the Baltimore & Ohio Co. will erect machinery for handling coal and ore at Cleveland, and build large grain elevators.

Cooperstown & Charlotte Valley.—Work on the line between Davenport and Bloomville, N. Y., is making rapid progress, the grading being nearly completed. It is thought that this portion will be completed by June, and the road in operation from Cooperstown to Kingston, N. Y.

Kinderhook & Hudson.—Work has been resumed on this New York road between Scottville and Stockport.

Philadelphia, Wilmington & Baltimore.—The annual report of this company for the year ending Oct. 31, 1889, shows the following results from operations:

Gross earnings	$6,498,936
Operating expenses	5,027,712
Net earnings	1,471,224

Lancaster & Hamden.—At a recent meeting of the stockholders the following directors were elected: JAMES H. BALLARD, WILLIAM H. MOWERY, JOHN T. O'GIER, THEODORE MITHOFF, PHILIP RISING, JOHN G. REEVES, B. F. DUNN, WILLIAM B. MACCRACKEN, J. H AXLINE, P. W. BININGER, and THOMAS O. H. TARPY. The road is under construction from Tarlton, O., south to Wellston, O., 60 miles. About 20 miles of the grading have been completed and 6 miles of track laid.

Baltimore & Eastern Shore.—Grading is in progress on this road from Preston, Md., to Hurlocks.

Western New York & Pennsylvania.—The annual report of this company for the last fiscal year shows the following results from operations, as compared with the previous year:

	1888-89	1887-88
Gross earnings	$3,386,658	$3,061,565
Operating expenses	2,699,336	2,205,432
Net earnings	687,322	856,133

Delaware River & Lancaster.—At a meeting of the stockholders recently held the following officers and directors were elected: President, ROBERT CRANE; Vice-President, AUSTIN GALLAGHER; Secretary, ISAAC W. GULDEN; Treasurer, GEORGE CRANE; Solicitor, E. D. NORTH; Directors, FOBERT CRANE, of Philadelphia; WILLIAM A. MORTON, of Lancaster; Dr. R. M. BOLENIUS, of Lancaster; GEORCE B. WILSON, of Lancaster; JOEL WENGER, of West-Earl; E. D. WHITE, of Churchtown; AUSTIN GALLAGHER, of New York; Dr. J. K. LINEWEAVER, of Columbia; ISAAC W. GULDIN, of Reading; LEVI BENJAMIN, of Coventry; THOMAS BRIGGS, of Newton; ISAAC GERHART, of Telford. The line is expected to be completed within a year.

Columbus, Hocking Valley & Toledo.—The annual report of this company for the year ending Dec. 31 1889, shows the following results from operations:

Gross earnings	$2,509,518
Operating expenses	1,429,208
Net earnings	1,080,310

Croton Valley.—This short road running from Croton Valley, N. Y. through Westchester County, is to be extended to the Connecticut State line.

Philadelphia & Reading.—The annual statement of this company for the year ending Nov. 30, 1889, shows the following results from operations:

Gross earnings	$19,018,673
Operating expenses	10,918,591
Net earnings	8,100,082

Projects and Surveys.

Walhonding Valley.—W. R. POMERENE, of Coshocton, O., Secretary, sends us the following information:

The road is to run form Kinbailton, O. through Coshocton, Walhonding, Gann, Loudonville and Mansfield, O., connecting the Cleveland & Marietta R. R. with northwestern Ohio. The total length of the road is 84 miles of which 70 miles are now being located. The work is generally light; maximum grade 21 ft. per mile, and maximum curve 8°. There will be considerable masonry and bridge work. The road is being built to furnish an outlet for the Coshocton coal fields to the northwest. It is intended to build the road this year. The company was incorporated Dec. 12, 1889. A. J. WARNER, of Marietta, O. is President, and J. A. HANLON, of Canton, O., is Chief Engineer.

Clarendon & Pittsford.—The right of way has all been secured and surveys are nearly completed for an extension from Proctor north to Brandon, Vt. It is stated that the intention is to build the road north to lake Champlain and obtain an outlet to the west by water. It is also probable that the line will be extended south to Greenwich. The road if built will pass through the marble belt of Vermont and will furnish the Vermont Marble Co., which owns a large number of the quarries, on independent line to the west.

Plymouth & Bournedale.—A committee has been appointed by the Commercial Club of Plymouth, Mass., to arrange for a survey for a railway from Plymouth to Bournedale, Mass., a distance of about 15 miles, and to prepare estimates on the cost of construction. GEO. I. BRIGGS, of Bourne, Mass., is interested.

Pittsburg & Mount Lebanon.—Chartered in Pennsylvania to build a line of railway 5 miles long. Among the incorporators are: JOHN G. MACCONNELL and J. M. SCHAFER, both of Pittsburg, Pa.

Troy & New England.—A correspondent writes us that this road is projected to run from Troy, N. Y., to a connection with the Lebanon Springs R. R. a distance of 35 miles, Surveys for the line have just been commenced. C. E FOGG, of Poughkeepsie, N. Y., is the engineer in charge, WALTER P. WARREN is President.

East River.—This company has been incorporated in New York to build a railway from a point in Brooklyn, N. Y. near South Seventh St. to and under the East River by a tunnel to a point in New York City near Broom St. Among the incorporators are: T. A. PATTERSON, of Brooklyn, J. C. O'BRIEN, and ALEX. CURTIS, of New York City.

New Jersey.—It is reported that an effort is on foot to supply the Saddle River Valley, New Jersey, with railway facilities. It is proposed to build a railway from a point in the Valley to connect with the New York, Susquehanah & Western R. R. and possibly with the West Shore R. R., through to Rockland County. The promotors of the enterprise, who are New York business men living at Arcola and Rochelle Park, are prepairing articles of incorporation.

SOUTHERN.—Existing Roads.

Tavaries, Apopka & Gulf.—This Florida road has been sold to HENRY JACKSON and others of New York to satisfy a claim in favor of the Central Trust Co. of New York. The selling price was $100,000.

Cumberland Valley.—At a recent meeting the following officers were elected: President, DAVID WILLS; Secretary, T. M. MAHON; Treasurer, D. J. FOLEY. Directors: DAVID WILLS, J. P. CULBERTSON, J. W. HUMBIRD, C. W. HUMRICHHOUSE, J. W. MCPHERSON, GEO. B. COLE, J. M. WOOD, D. J. FOLEY, and W. F. EYSTER.

Chattanooga, Rome & Columbus.—This company is reported to be making arrangements to begin work on the extension from Carrollton to Columbus, Ga., at an early date. It is also stated that a branch is to be built from Crawfish Springs to McLemore's Cove, about 25 miles, to open up coal lands owned by the company.

Charleston, Sumter & Northern.—A circular has been issued from headquarters announcing that the name of the Eutawville, R. R. has been changed to the above.

Alabama Midland.—A large force of men are at work on the Montgomery, Tuscaloosa & Memphis R. R., and work is making rapid progress. It is expected that the entire line of the road from Montgomery to Tuscaloosa, Ala., will be in operation by Jan. 1, 1891.

Orange & Keysville.—Gamble & Greenville, of East Saginaw, Mich., have the contract for building 17 miles of this Virginia road. It is probable that the same firm will take the contract for building the remainder of the

ine. THOS. MOORE, of 912 East Main St., Richmond, Va., is Chief Engineer.

Chesapeake & Ohio.—A bill has been introduced into the Virginia Legislature incorporating the Potomac & Piedmont Ry. Co. in the interest of this company, to build a railway from Alexandria or Quantico, Va., to some point on the main line of the C. & O. R. R. east of the Blue Ridge Mountains.

Roanoke & Southern.—An election will be held at Roanoke, Va., Feb. 11, to vote upon the subscription of $100,000 of bonds in aid of this enterprise.

Georgia, Southern & Florida.—Grading is making rapid progress on this line from Macon, Ga. to Birmingham, Ala'

Columbus Southern.—Tracklaying is progressing on this road at the rate of 1½ miles per day. Track has been laid to Weston, 11 miles south of Richland, Ga., and will be laid to Dawson within two weeks. It is expected that the line will be completed to Albany by April 1.

Louisville & Nashville.—Work on the extension of the Tuskaloosa branch of the Birmingham Mineral R. R. is well under way. The grading is nearly finished. The extension is 6 miles long and will open up a number of new mines.

East & West R. R. of Alabama.—This company will it is stated, extend its road to a connection with the Marietta & North Georgia R. R. at Canton, Ga., about 17 miles.

Virginia Midland.—It is reported that this company will build a 25 mile branch to Hot Creek, Va.

Projects and Surveys.

Fayetteville & Aberdeen.—Z. W. WHITEHEAD, of Fayetteville, N. C., Secretary, has sent us the following data:

The surveys have been completed for the road, which is projected to run from Fayetteville, N. C. northwest, to a connection with the Raleigh & Augusta Air Line R. R. at Aberdeen, N. C., a distance of 45 miles. The route is through a heavily timbered country. Nearly all of the right of way has been secured and a considerable other local aid has been obtained. It is probable that work will soon begin on this road and the line built as soon as possible. JOHN BLUE, is President, and W. J. MCDUFFIE, of Fayetteville, N. C., is a director.

Birmingham & Tennessee River Railway & Navigation Co.—A company by this name has been incorporated in Alabama to build a railway from Birmingham to Guntersville, Ala. The company also propose, to run a line of steamers on the Tennessee River in connection with the railway.

Pittsburg & West Virginia.—The route of this proposed road is from Pittsburg, Pa., via Connellsville, Pa., Rowlesburg, Buckhannon, Huntersville, and Ponceverte, W. Va., and New Lexington, Va. Its length will be about 275 miles. Ex-Governor FITZHUGH LEE of Lexington, Va., is President.

Portsmouth & Smithville.—A railway company by this name has been incorporated in Virginia,

Georgetown & Falls Church.—A bill has been introduced into the Virginia Legislature incorporating a railway company by this name. The company proposes to build a railway from a point on the Aqueduct Bridge, D. C. to Falls Church, Va.

Port Gibson & Alabama.—This company was chartered in 1884 to build a railway from Port Gibson, Miss., southeast to the Alabama State Line. It is now rumored arrangements have been completed for the early construction of the road.

NORTHWEST.—Existing Roads.

West Duluth Incline.—The West Duluth steel works are building an incline for transporting coal, coke and ore from the stock house to the top of blast furnace stack. The Berlin Iron Bridge Co., of East Berlin, Conn. has the contract, and a force of men are now at work erecting the staging or falsework under the direction of H. L. HANNA. The iron work will be 268 ft. long but the tracks will be a little longer, as they will extend down into the charging well. The incline will run on a uniform slope to within 3 ft. of the stack where the track becomes level, the total elevation being nearly 100 ft. The falsework is completed for about 120 ft. from the lower end of the incline. There will be five spans, one each 30, 40, and 58 ft. and two of 70 ft. each, supported on four iron towers of lattice work which are respectively 23, 32, 58, and 72 ft. high. The tallest tower stands on a base 12 by 18 ft., which decreases to 12 ft. by 16 ins. at the top. The spans are composed of two parallel I beams 3 ft. high and 10 ft. apart. The track, which is of 7 ft. 2 in. guage, rests on ties supported on angle irons at the base of the girders. The whole structure of iron will be solidly anchored to the masonry of the charging well. It will take about five weeks to complete the work on the incline.

Jacksonville, Louisville & St. Louis.—This company has been incorporated in Illinois to absorb the old Jacksonville Southeastern Ry. Co., operating a railway from Jacksonville to Mt. Vernon, Ill. The capital stock is $1,500,000.

Projects and Surveys.

Omaha & South Dakota.—We have received the following information from R. M. SPRINGER, of Forest City, So. Dak.:

The road is to run from Forest City, So. Dak., via Blunt, Mitchell, and Yankton, So. Dak., to Omaha, Neb., a distance of about 350 miles. The preliminary survey of the line began Jan. 10, 1890. The route is through a prairie country. The principal business will be in live stock, wheat, flour, coal, and lumber. There will be one large bridge across the Missouri River at Yankton. The company was incorporated Dec. 20, 1889. G. P. HOSMER, of Lockport, N. Y., is President, W. W. OLNEY, of Blunt, So. Dak., Chief Engineer, and J. K. SMITH, of Mitchell, Secretary.

Alton, Venice & East St. Louis.—Chartered in Illinois to build a railway from Alton, via Venice to East St. Louis, Ill. The principal office is located at Alton. The incorporators and first Board of Directors are: H. D. SEXTON, East St. Louis; WILLIAM E. SMITH, HENRY WATSON, Z. B. JOB, JOHN N. DRUMMOND, Alton; T. J. IRISH, and JOHN WEDING, Nameoki; A. E. MILLS, Upper Alton; and FRANK MCCAMBRIDGE, of Venice, Ill.

Missouri River, North Platte & Denver.—At a meeting of the stockholders recently held, the following officers were elected: President, LORAN CLARK, Vice-President, T. C. PATTERSON, Treasurer, T. J. FOLEY, and Secretary, F. H. SMITH. The company has $224,000 of bonds already subscribed, and it is stated that this amount can easily be raised to $300,000. The road is projected to run from Albion, Neb., to Denver, Col., a distance of 450 miles. The division from Albion to Wallace, Neb., 314 miles, has been surveyed.

Hudson Bay.—It is announced that the Dominion Parliament will be asked at its coming session to vote $4,000,000 toward the Hudson Bay railway scheme, owing to the repeated demands of the Northwest for carrying out the work. The scheme contemplates the building of a line from Winnipeg or Edmonton to Hudson Bay, and the establishment of a line of steamers or sailing vessels between Churchill or some other Hudson Bay port and Liverpool.

SOUTHWEST.—Existing Roads.

Fort Worth & Albuquerque.—We are indebted to CHAS. C. BLACK, 405 Whitney Building, Kansas City, Mo. President, for the following information concerning this enterprise:

The road is to run from Fort Worth, Tex., in as nearly a direct line as possible to Albuquerque, N. M., a distance of about 600 miles. About 30 miles of the line has been located and a large portion of the preliminary surveys completed. Contracts for constructing 100 miles of the road have been let and work is now in progress. The work will be light; maximum grade 1 per cent. and maximum curve 4°. For the first 30 miles to Springtown the road traverses a thickly settled country producing large quantities of cotton, corn, sorgum, hemp, and live stock. From Springtown northwest into Young County the route is through a rich agricultural country and will tap some of the finest coal fields in the southwest. From this point on, the route is through a country now devoted to stock raising but which is capable of producing good crops of all the staples common to the southwest. The general impression that this region is almost a desert region is a mistaken one. The land now produces large crops of grass, and water when not found in lakes and streams can be obtained by boring to a depth of from 50 ft. to 125 ft. There is very little timber along the route. It is thought that the road will do a large business in farm produce, coal, iron, building stone, salt, natural gas, fire-clay, ochre, and timber from the forests of Arkansas and Louisiana. The Chief Engineer is STEPHEN D. TEMPLE.

Choctaw Coal & Railway Co.—E. D. CHADWICK, of McAlester, I. T., Manager, sends us the following data:

The road to be built by this company is to run east and west through Indian Territory and Arkansas, a distance of about 400 miles. The contract for building the first 100 miles has been let to Garvey Bros., and about 1,000 men are now at work on the line. Forty miles of the road are completed and in operation. S. L. SHELLENBERGER is Chief Engineer.

San Antonio & Aransas Pass.—Work on the line from West Point to Waco, Tex., is making rapid progress. About 18 miles of track from Giddings north has been laid since Jan. 1.

Denver, Texas & Fort Worth.—A press dispatch says: There is talk of the Denver, Texas and Fort Worth Co. doing some extensive railway building this year. The indications are that the line will be extended from Denison, Tex. to Sherman, thence to Dallas, Tex., also that the extension that runs from Dallas to Waxahachie will be continued to Hillsborough. A branch is also talked of from Taylor to Bastrop, Tex.

Projects and Surveys.

Camden, Louisiana & Sabine Pass.—Incorporated in Arkansas to build a railway from Camden, Ark., to the Louisiana State Line, a distance of 50 miles. It is the intention to extend the road south through Louisiana to Sabine Pass, ultimately. The officers are: A. S. MORGAN, President, W. E. MCRAE, Vice-President, J. B. FREIDHEIM, General Manager, CHAS. K. SITHEN, Treasurer and S. Q. SEVIER, Secretary.

Wichita, McPherson & Southern.—This company has been chartered in Kansas by a number of local capitalists to build a railway from Wichita to McPherson, Kan., a distance of about 55 miles.

Gulf, Sabine & Kansas City.—This company proposes to build a railway about 90 miles long in Louisiana.

ROCKY MT. AND PACIFIC.—Existing Roads.

Denver, Texas & Fort Worth.—Grading has been commenced on the branch from Chicosa, Col., up Road Cañon to the coal lands of the Colorado Coal & Iron Co.

Union Pacific.—The contrators for the extension to Los Angeles, Kilpatrick Bros. & Colins are pushing work as rapidly as possible. Additional forces will be put to work as soon as they can be obtained.

Denver & Rio Grande.—Tracklaying will soon commence on the Rio Grande Junction Ry. A large quantity of rails is at hand. The grading is nearly completed from Newcastle, Col., to Dubuque, Col.

Projects and Surveys.

Portland & Oregon City.—Chartered in Oregon to build a railway from East Portland to Oregon City, Ore. The incorporators are: D. P. THOMPSON, FRANK DEKUM, J. B. DAVID, GEORGE H. DURHAM, R. L. DURHAM, CLEVELAND ROCKWELL, and H. C. STRATTON.

East Portland & Barlow.—This company has been chartered to build a railway from East Portland to Barlow Station, Ore. Among the incorporators are: F. V. DRAKE, and GEORGE SHEPPARD.

Portland & Willamette Falls.—Incorporated to build a railway from Portland to Oregon City, Ore. The incorporators are the same as for the East Portland & Barlow Ry. Co.

FOREIGN.

Sonora, Sinola & Chihuahua.—The construction company organized last summer to build this road has been reorganized and is now figuring on new contracts. It is not probable that anything will be done for some two months yet.

Texas, Topolobampo & Pacific.—The concession granted this company has been declared forfeited. The concession was granted in 1881 and modified in 1882, in 1886, and in 1888. Under the last modification the company being obliged to build 50 kilometers of road within a year. This has not been done.

Mexican Pacific.—A large force of men are at work on the section of this road between Tonalá and San Cristobal Las Casas. This division is to be completed by Jan. 1, 1891.

Mexico.—The Mexican Government has granted a concession to Gen. Hermenegildo, Carrillo & Co. for a narrow gauge railway from San Juan de los Llanos, via Santa Lugarda, Coyuaco, Zacapoaxtla, and Tlatlanqui to Tezuitlan. Construction is to begin within a year and the road must be completed in 5 years. A subsidy of $6,000 per kilometer is granted in aid of the enterprise.

Peru.—The Peruvian Government has signed the GRACE bondholders' contract, which was authorized by Congress Oct. 29, 1889. Under this contract the Government cedes for 66 years railways from Payta to Piura, 57 miles, from Pacasmayo to Yonan, 82 miles, from Trujillo to Ascope, 56 miles, from Chimbote to Suchiman, 32 miles, from Lima to Ancon, 22 miles, from Callao to Chicla, 87 miles, from Peso to Ica, 46 miles, from Mollendo to Arequipa and thence to Puno, 325 miles, from Juliaca to Santa Rosa, and from Guadalupe Salaverdy to Trujillo, a total of about 750 miles. It is proposed to extend these roads in the aggregate 800 miles and engineers will soon begin work on the projected extensions.

RAPID TRANSIT.

Electric Railways.—*Athol, Mass.*—An electric railway is to be built to Orange, 5½ miles. A company with a capital stock of $75,000 will be organized by SUMNER T. DUNHAM, R. S. BROWN, and M. L. CLIFFORD, of New York, A. BANGS, and CONVERSE WARD, of Athol.

Lancaster, Pa.—The City Council has passed an ordinance permitting the Lancaster and East End Street railway companies to operate their lines by electricity.

Louisville, Ky.—It is proposed to extend the electric railway to Parkland.

New Orleans, La.—The Crescent City Ry. Co. has been granted permission to operate its lines on the storage battery system, and a contract for the batteries has been made with the Electric Traction & Mfg. Co.

Granville, O.—The City Council has granted a franchise to the Newark & Granville Electric Ry. Co. President, REINHARDT SCHEIDLER; Secretary, J. A. FLORY.

Champaign, Ill.—The Citizens Electric St. Ry. Co. has been incorporated by G. J. W. DAVIDSON, W. S. RAYBURN, and JOHN W. BEERS. Capital stock, $150,000.

Belleville, Ill.—Mayor BARTEL has signed the ordinance authorizing the Citizens Ry. Co to change its motive power to electricity.

Colorado Springs, Col.—The El Paso Rapid Transit Co. has been incorporated and has bought out the Colorado Springs & Manitou Ry. Co. The present lines will be completed and extended and an electric system will be introduced.

Eugene City, Ore.—An electric railway is to be built, and $5,000 has been subscribed.

Toronto, Ont.—The Metropolitan St. Ry. Co. has applied for a franchise for a street railway on Yonge St. The city will not make any arrangements yet, on the advice of the City Solicitor, as the Toronto St. Ry. Co. has by its franchise a monopoly of the streets for railway purposes.

Street Railways.—*Richmond, Va.*—The Southside Land & Improvement Co. has applied for an extension of time to July 15 for the completion of its street railway line. JOHN C. ROBERTSON is General Manager.

Roanoke, Va.—The Citizens Street Ry. Co. has been organized by H. S. TROUT, P. L. TERRY, J. H. SANDS, D. W. FLICKWIR, J. A. JAMISON, J. M. GAINSILL, W. E. BIBB, JAMES S. SIMMINS and E. H. STEWART. The company proposes to build on any streets, with the consent of the City Council, and to extend into the country with the consent of the County Commissioners.

Paris, Ky —The Paris Street Ry. Co. will build a line 2 miles long, and will purchase the rails shortly. For particulars addr ss Mr. JAMES M. THOMAS.

Findlay, O.—The Wain, Cross & Wyoming St. Ry. Co. has been incorporated. Capital stock, $5 000.

Cleveland, O.—The Woodland Ave. & West Side St. Ry. Co. has been granted permission to extend its line on Lorain St.

Argentine, Kan.—The Mardis-Thayer St. Ry. Co. is surveying its line to Kansas City.

Beatrice, Neb.—The Glenover St. Ry. Co. has been incorporated by EDWARD B. SHEVER and CHARLES O. GATES. Capital stock, $20,000.

Fresno, Cal.—The trustees have granted a franchise to E. B. PERRIN and J. R. WHITE.

Cable Railway.—*Buffalo, N. Y.*—The Committee on rapid transit appointed by the Black Rock Business Mens Association has reported in favor of a cable line.

Dummy Lines.—*Memphis, Tenn.*—The Prospect Dummy Line was sold Jan. 7, to THOMAS T. DUFFIN, at $55,000.

Portland, Ore.—A dummy line from East Portland to Oregon City is projected.

Elevated Railways.—*New York, N. Y.*—A meeting was held last week at the Athenæum in 155th St. to discuss the needs of improved rapid transit facilities. Mr. LAWSON N. FULLER advocated the extension of the elevated railroad up the Boulevard to King's Bridge and around Fort George. He said that consent of property owners on the Boulevard for 31,000 ft. was necessary to be secured and that 17,500 ft. had been secured and 500 ft. pledged.

Jersey City, N. J.—The mayor has signed the ordinance for an elevated railway from the Communipaw Ferry to Bergen Hill.

Brooklyn, N. Y.—The commission appointed to consider the proposition for an elevated railway on Atlantic Ave. has appointed Mr. SAMUEL R. PROBASCO as its engineer.

HIGHWAYS.

Colorado.—Petitions for new roads will be laid before the Commissioners of Jefferson County, at Golden, Col. The country is settling up fast and new roads and bridges are becoming necessary.

Long Island.—The Long Island farmers want macadamized roads leading to Long Island City. To obtain them a bill will be introduced in the Legislature to bond Queen's County for $1,000,000 or more. This will include Long Island City, whose taxpayers, it is claimed, will not be benefited by the road. Several meetings have been held and those for and against the improvement of the county roads have been given a chance to be heard. Thus far the matter has not obtained any tangible shape but the bill will be hard pressed. Should it pass it will necessitate the farmers placing tires 3 ins. wide on the wheels of their wagons. Mayor GLEASON and the taxpayers of Long Island City will oppose it. The Highway Commissioners of Jamaica have taken action towards the opening of Hillside Ave., west, from the Hoffman Boulevard to Myrtle Ave., at Richmond Hill. Hillside Ave. will be open from Rocky Hill, Queens, to Myrtle Ave., in the spring, and will afford relief to the people of Jamaica, who have no proper road now, except the Jamaica and Brooklyn turnpike, which is in bad condition.

Pennsylvania.—At a meeting of the Pittsburg Chamber of Commerce a resolution was presented by J. B. SCOTT endorsing the efforts being put forth by the State Board of Agriculture looking to the improvement of the country roads. The resolution was adopted and Capt. THOMAS B. ROBERTS was appointed delegate to represent the city of Pittsburg at the meeting of the Board to be held at Harrisburg Jan. 22 and 23.

Tennessee.—The people from three to five miles west of Knoxville and in the vicinity of Third Creek Church have petitioned the county court to build three miles of macadam road. Beginning on the Clinton pike 2 miles from Knoxville they want a road built to Third Creek Church, a distance of 3 miles. This will be one of the most important and valuable pieces of road in Knox County, and the building of the three miles of road will practically give the Third Creek neighborhood five miles of macadamized road to the city and at a comparatively small expense.

CONTRACTING.

Street Work.—*Wichita, Kan.*—The following proposals have been received by H. H. JACKMAN, City Engineer. Paving: J. E. Riley & Co., $2.53 per sq. yd. for Fort Collins sandstone or sand, $3 for Sioux Falls granite or sand, $2 70 and $2.75 for Trinidad and Unitah sheet asphalt, $1.87 and $2.43 for red cedar blocks on sand and on concrete, $2.75 for bois-d'arc blocks on sand, $1.89 for vitrified brick on sand, $2 02½ for vitrified brick on concrete. J. Grant Asphalt Paving Co., $2.65 for Trinidad sheet asphalt. Barber Asphalt Paving Co., $2 80 for Trinidad sheet asphalt. Mulvane & Kepley, $2.63 for Fort Collins sandstone on sand, $1.89 and $2.39 for red cedar blocks on sand and on concrete.——Curbing: J. E. Riley & Co., 67 cts. per lin. ft. for artificial stone, 82½ cts. for 4-in. sandstone. Barber Asphalt Paving Co., 85 cts. for 4-in. sandstone. Mulvane & Kepley, 85 cts. for sandstone. W. H. Decker, 55 cts. for artificial stone, 90 cts. for sandstone. J. W. Sumption, 50 cts. for artificial stone. F. L. Rulla, 50 cts. for artificial stone.——Grading: J. F. Riley & Co., 30 cts. per cu. yd.; J. Grant Asphalt Paving Co., 26 cts.; W. H. Decker, 28 cts. The contract for paving was let to J. E. Riley & Co. at $2 02½ for vitrified brick on concrete; W. H. Decker got the contract for grading. New bids are invited for curbing. The engineer's estimates were $2,06 for brick on concrete, 32 cts. for grading, 69 cts. for artificial stone curbing, 85 cts. for sandstone curbing.

Natchez, Miss.—The Arlington Land Co. has awarded the contract for grading to T. W. Morris, at 14 cts. per cu. yd.

Alameda, Cal.—The contract for the macadamizing of Pacific St. has been let to G. W. Smith, as follows: regrading, 24 cts. per cu. yd.; filling, 10 cts. per cu. yd. curbing, 12 cts. per lin. ft.; macadamizing, 6¾ cts. per sq. ft.

Wall.—*Cumberland, Md.*—The committee appointed to report on the constuction of a stone wall along Will's Creek from the gas house to the chain bridge has submitted its report, with a letter from City Surveyor GAFFNEY. They stated that President DAVIS, of the West Virginia Central Ry. Co., would pay one-third of the cost of construction. Mr. GAFFNEY gives an estimate of from 1,200 to 1,500 cu. yds., if the wall is raised one foot above the high water mark of last year. The lowest estimate of the cost is $2,500 which amount would be increased by the condition of the weather and the state of the water in Wills Creek, if the work be done at a time other than when the water is very low. Mr. GAFFNEY'S estimate was examined and approved by Mr. J. W GALBRAITH, C. E., of the West Virginia Central Ry.

Levees.—At Vidalia, La., a contract of 10 000 cu. yds. has been awarded to W. A. Oliver. At L'Argent, La., a similar contract has been awarded to A. P. Martin.

Sewers.—*Tonawanda, N. Y.*—Mr. BENJ. VAN VRANKEN, of Schenectady, N. Y., writes that his tender for the sewerage work was $94,661. The other tenders were given last week.

City Hall.—The contract for the city hall building at Wichita, Kan., has been awarded to R. Rogers at $61,965 for Augusta stone. The estimate of the City Engineer, H. H. JACKMAN, was $69,887. There were eleven bidders who put in bids for different kinds of stone.

PROPOSALS OPEN.

Street Work.—Grading and cobblestone paving on Ralph St. JOHN P. ADAMS, Commissioner of City Works, Brooklyn, N. Y. Jan. 22.

Street Cleaning.—Cleaning streets and removing dirt and ashes. JOHN P. ADAMS, Commissioner of City Works, Brooklyn, N. Y. Jan. 23.

Building & Machinery.—Lumber, lime, cement, iron, etc., for power house. Machinery to handle gates of State power house; line-shafting and box-pulleys, horizontal duplex compressor 17 x 48 ins. hydraulic pump 3½ x 8 ins.; accumulator irrigating pump 14 x 36 ins., 3-throw capacity 1,000 galls. per minute, six 87-in. turbine wheels. The detailed plans for said machinery can be examined by parties desiring to bid on the same at the office of the engineer at Folsom State Prison. Specifications of the same furnished upon application. W. W. CUNNINGHAM, Clerk of State Prison, Folsom, Cal. Jan. 29.

Lumber.—White pine lumber, 12,000 ft.; for New York navy yard. JAMES FULTON, Paymaster General, U. S. N., Navy Department, Washington, D. C. Jan. 30.

Stand-Pipe.—Steel stand-pipe, 14 ft. diameter, 48 ft. high; to be erected on an 80-ft. brick tower now completed; steel plates of 60,000 lbs. tensile strength; 3-8, 5-16, and 1-4 in. thick. R. R. GIBONS, Chairman Water-Works Committee, Princeton, Ill. Feb. 1.

Bridges.—Three truss bridges over the San Antonio River. BRYAN CALLAGHAN, Mayor, San Antonio, Tex. Feb. 1.

Bridge.—Plans, specifications, and bids for a bridge over Ten Mile Creek on the Marysville road, near Kramich. J. S. TOOKER, Clerk of County Commissioners, Helena, Mont. Feb. 4.

Building Supplies.—For Congressional Library building. 1. 6,000,000 best red hard-burned bricks and 8,000 best red skewback bricks. 2. 100,000 best red hand-made bricks. 3. 4,000 cu. yds. of river sand. 4. 800 cu. yds. of broken stone. 5. 237,500 ft. of lumber. 6. Small supplies of miscellaneous hardware. 7. 81,100 small iron castings. 8. 1,200 bbs. Portland cement. 9. 1,900 ft. cast-iron drain and pressure pipe and fittings. BERNARD R. GREEN, Engineer and Superintendent, 145 E. Capitol St., Washington, D. C. Feb. 6.

Court House.—GEO. HUDSON, County Clerk. Key West, Fla. Feb. 6.

Wharf.—Wharf, revetment, etc., for U. S. Revenue Station, Placquemine Parish, La. J. H. WINDRIM, Supervising Architect, Treasury Department, Washington, D. C. Feb. 8.

Bridge.—Plans, specifications, and bids for iron bridge across Rocky Creek. JOHN BUCHANAN, Clerk of Lavaca County, Hallettsville, Tex. Feb. 10.

MANUFACTURING AND TECHNICAL.

Signals.—The Hall Railway Signal Co., of Meriden, Conn., and 50 Broadway, New York City, has dissolved its former relations with the Wharton Railroad Switch Co., of Philadelphia, and will begin business at once putting in electric signals for the protection of grade crossings, and junctions, drawbridges, etc.

Car Wheels.—The Milwaukee Car Wheel & Foundry Co. has increased its capital stock from $90,000 to $125,000.

Cable Railway Devices.—The Chicago Cable Device Co. has been incorporated by ALFRED B. ARNOLD, T. B. ARNOLD, GEO. R. SIMMS, ALBERT G. CORBE and A. B. CHAMPION.

The Illinois Steel Co., of Chicago, Ill., has reported the following business for 1889: Capital issued, $17,622,600; number employed, 9,247; total wage, $4,577,000; value of product, $19,000,000; pig metal produced, 372,695 tons; rails, 451,147 tons; wire, 43,488 tons; merchant bar nails, 60,230 tons; billets, 50,289 tons; spiegel and ferro-manganese, 18,031 tons; beams and slabs, 4,030 tons. The works consumed 775,000 tons of ore, 575,000, tons of coke 140,000 tons of coal and 200,000 tons of limestone.

Machine Shops.—The Denver Union & Ry. Terminal Co. has been incorporated at Denver, Col., by J. K. CHOATE, WILLARD TELLER, WM. ASHTON, J. B. GILCHRIST and SCOTT BRYAN, all of the Union Pacific road except Mr. TELLER, who is the attorney for the line. The purposes of the company are to purchase, lease or otherwise acquire and hold lands and rights of way and to build thereon foundries and machine shops, round houses and other buildings or works for the construction, repair and care of locomotives, cars and all kinds of rolling stock.

The Bucyrus Foundry & Mfg. Co., of Bucyrus, O., will hereafter be known as the Bucyrus Steam Shovel & Dredge Co. This title will better describe their business, which has largely increased in the manufacture of steam shovels, dredges and railway wrecking cars. There will be no change in the management. The capital stock will be increased to $150,000 to accommodate the constantly increasing business, and allow of the necessary extension of plant. The reputation of this firm for high grade work is firmly established, and it has connected with it some of the oldest engineers in their line of specialities, which enables it to successfully undertake the most difficult work and frequently furnish efficient machinery for works of excavation and dredging heretofore thought to be impossible.

Locomotive Construction in 1889.—During the past year the Schenectady Locomotive Works, of Schenectady, N. Y., have built 220 engines, including 1 Strong and 1 compound engine. The Cooke Locomotive & Machine Co., of Paterson, N. J., 54 engines and 5 rotary snow shovels. The Taunton Locomotive Works, of Taunton, R. I., 8 engines, including 2 Mason "bogie" engines. The Baldwin Locomotive Works, of Philadelphia, Pa., 836 locomotives, 2 of which had one pair of drivers, 296 two pairs, 358 three pairs and 180 four pairs. The Lima Machine Works, Lima, O., 46 Shay patent logging locomotives. The Mount Savage Locomotive Works have turned out 2 consolidation engines.

Conover & Co., manufacturers of engines, machinery, etc., have moved from Newark, N. J, to New York. Their office is at 95 Liberty St.

The Hale Pavement Co., of Staunton, Va., reports that some brick paving on this system is to be laid at Roanoke and Norfolk, Va., in the latter place under heavy traffic. Guild & White, contractors, of Chattanooga, Tenn., are said to have offered to put down this pavement, to be paid for only if satisfactory.

Heller & Brightly, of Philadelphia, Pa., manufacturers of drawing and surveying instruments, etc., dissolved partnership in July, 1889, and Mr. HELLER has continued at the old place of business. Mr. BRIGHTLY has now built a new factory at Germantown Junction and will manufacture a full line of instruments.

Riehle Bros., of Philadelphia, Pa., have an order for one 160,000 lbs. self-adjusting railroad scale for the Savannah, Florida & Western Ry., and one 10-ton Robie patent screw jack for the Mont Alto R. R.

Locomotives.—The Pittsburg Locomotive Works, of Pittsburg, Pa., have delivered 5 locomotives to the Pittsburg & Lake Erie.

The Baldwin Locomotive Works, of Philadelphia, Pa., are completing an order of 55 locomotives for the Pennsylvania.

The Taunton Locomotive Mfg. Co., of Taunton, Mass., has built 3 engines for the Baltimore & Ohio.

The Rogers Locomotive Works, of Paterson, N. J., have delivered another ten-wheel engine to the Norfolk & Western. They have an order for 15 engines for the Louisville, New Albany & Chicago.

H. K. Porter & Co., of Pittsburg, Pa., builders of light locomotives, have recently shipped motors to Tacoma, Elmira, Hoboken, San Francisco, and Muncie, and locomotives to Worcester, Tampa, and Newark. Also for export to South America.

Cars.—The Centropolis Car & Bridge Co., of Centropolis

olis, Mo., has completed a large order of freight cars for the Kansas City & Southern; also a number of refrigerator cars for the Dold Packing Co., of Kansas City. The company has several large orders for freight, refrigerator, and street cars. Mr. SHOOP, President of the company, says that the present rate of contracts will necessite an addition to the works early in the spring.

The St. Charles Car Co., of St. Charles, Mo., is building 2 cars for the Rio Grande & Western, costing $12,000 each, and 2 special cars for a Northern road, costing $12,500 each. The most recent improvement to the concern is the street-car department, where is now in process of construction 40 electric street cars for the 6th St. line in Milwaukee. These cars are a new departure. On each end is a small vestibule for the motors. Ingress and egress is made between the main car and these vestibules which are securely protected from the weather. The cars are large and are provided with stoves and the Hubbard brakes.

The Jackson & Sharpe Mfg. Co., of Wilmington, Del., has the contract for the passenger cars for the Kennebec Central.

The Kansas City Car & Wheel Works, of Kansas City, Mo., have completed 100 refrigerator cars for the Pabst Brewing Co., of Milwaukee.

Fences.—The Mississippi Hedge Co. is being organized by M. C. CARY, of Natchez, Miss., to build hedge fences.

Train Shed.—The Detroit Bridge & Iron Co., of Detroit, Mich., has an order for an iron train shed for the Grand Rapids & Indiana. It will be 600 ft. long, will cover 6 tracks and cost $100,000.

Wire Nails.—The Baackes Wire Nail Co., of Cleveland, O., was incorporated in December last, with a capital stock of $1,000,000. It has 40 acres of land inside the city limits and is erecting what is said to be the largest wire nail works in this country; they will consist of furnace, steel mill, rod mill, wire mill, and nail mill. The nails will be manufactured right from the ore. The works are expected to be in operation by May. President H. C. WELCH; Vice-President, Mr. BAACKES; Secretary, W. J. HILANDS. The office is in the Wade building.

BRIDGES, TUNNELS, AND CANALS.

Bridges.—***Warren, R. I.***—Bids will be received for the construction of an iron draw-bridge over the Warren River at this point. Bids will be received on superstructure and substructure separate. Address DANIEL L. TURNER, Warren.

New York, N. Y.—At a recent meeting of the Board of Estimate and Apportionment, Commissioner GILROY was instructed to prepare working plans and estimates for the proposed viaduct from 155th St. and St. Nicholas Ave., to Seventh Ave., at Macomb's Dam Bridge. The estimated cost of the viaduct is $503,402. It will be 1,500 ft. long and 60 ft. wide.

Brooklyn, N. Y.—A bill has been introduced into the New York State Legislature by Senator MACARREN of Brooklyn, providing for the construction of a bridge across the East River from Broadway, Brooklyn, to Grand St. New York.

Syracuse, N. Y.—A viaduct is to be built over the tracks of the Delaware, Lackawanna & Western R. R. at this place. The structure will cost about $50,000.

Columbia, S. C.—The Columbia, Newberry & Laurens R. R. Co., will build an iron bridge over the Broad River near this place. The bridge will cost about $60,000. CHAS. ELLIS, Jr., of Columbia, is Chief Engineer of the company.

Alabama Midland R. R.—The contract for building the bridge across the Alabama River for this road has been let to the St. Louis Bridge Co. Work is to begin at once.

Memphis, Tenn.—The bridge being built across the Mississippi River at this place by the Kansas City & Memphis Railway & Bridge Co. will be 2,258 ft. long. It will consist of 4 spans; one 225 ft., 10 ins. long, one 790 ft. 5 in. long, and two 621 ft. 5 ins. long each. There will also be a deck span connecting pier 4 with the west abutment. The structure is to be completed by Jan 1, 1892.

Walnut Ford, Ill.—The contract for building an iron bridge across Kickapoo River at this place has been let to the Massillon Bridge Co., of Massillon, O., It will cost $1,360.

Sioux City, Ia.—The soundings for the proposed bridge across the Mississippi River at this place are nearly completed.

Corpus Christi, Tex.—The Port Aransas Co. will receive proposals for building five short iron bridges.

New Orleans & Northwestern R. R. Co.—The plans for the bridge across the Tensas River, Arkansas, to be built by this company, have been approved by the Secretary of War. J. C. HUGH, of Meridian, Miss., is the Resident Engineer.

Cheyenne, Wyo.—Bids for the construction of the new stone viaduct at this place will be advertised for soon. It will cost $45,000. Address City Engineer.

Eagle Co., Col.—Bids will be received up to Jan 20, for the construction of a bridge across the Grand River in this county. No bid will be received that exceeds $8,200 for the bridge complete ready for travel. J. P. MAXWELL, Barcaly Block, Denver, Col., State Engineer.

Proposed.—Bridges are proposed at the following places: Fredericksburg, Va., Roanoke, Va., Norfolk, Va., Charleston, S. C., Daytona, Fla., Winona, Minn., Louisville, Neb., Rockford, Ill., Grand Forks, S. Dak. Sandoval, Ill., Ft. Worth, Tex., and Salida, Col.

ELECTRICAL.

Electric Lighting.—***Thomaston, Me.***—The Thomaston & Warren Electric Light & Power Co. has been incorporated under a recent charter. Capital stock, $50,000.

Boston, Mass.—The contract for lighting the streets by electricity, has been awarded to the Suburban Light & Power Co, at the following terms per lamp per night, City proper, South Boston, Dorchester, West Roxbury, cts.; 39.74 Roxbury, 37.99 cts. The difference between these prices and what the city has been paying is about $73,000 in favor of the city. The company is to begin furnishing lights to Roxbury, Dorchester, and West Roxbury in six weeks from the signing of the contract; South Boston in twelve weeks, and city proper in sixteen weeks. Contracts have been made with the existing companies to continue furnishing light to the city during the interim. An order has been passed requesting Mr. GEO. H. ALLEN, the Superintendent of Lamps to submit to the City Council an estimate of the cost of establishing and maintaining an electric light plant in the city, with a view to the city's establishing such a plant, for the purpose of furnishing its own lights.

Blackstone, Mass.—The town has voted to put in 17 arc lights of 2,000 c. p. They will be put in by the Woonsocket Electric Machine & Power Co.

Flushing, N. Y.—The Flushing Electric Light & Power Co. has been incorporated by HENRY CLEMENT, ALBION K. P. DENNETT, JOSEPH DYKES, THOMAS ELLIOT CHARLES FREY, JOHN HEPBURN, ARTHUR HERRING, SAMUEL MCCREERY, JOSEPH K. MURRAY, DAVID MASTER, GEORGE POPLE, and E. PLATT STRANTON. Capital stock, $30,000.

Brooklyn, N. Y.—The bids of the Citizens' and Municipal electric light companies, opened last week by J. P. ADAMS, Commissioner of City Works, were at the old prices of $182.50 per lamp per year.

Irvington, N. J.—A contract has been made with the Newark Electric Light Co. for 150 incandescent lamps at $2,500.

Suffolk, Va.—The Suffolk Electric Light & Power Co. has been organized.

Hampton, Va.—The Electric Light company has made a proposition to put in twelve lights of 1,200 c. p. for $1,100 a year if a contract is made for three years.

Barnesville, W. Va.—The Barnesville Electric Light & Gas Co. has been incorporated. Capital stock, $40,000.

Paris, Ky.—An electric light plant is being put in. For particulars address J. M. THOMAS.

Asheville, N. C.—The city will contract for electric lighting from Oct. 1, or may purchase its own plant. For particulars address Mr. C. D. BLANTON, Mayor.

Shelby, N. C.—A contract for electric lighting will be let shortly. For particulars address the mayor.

Ogden, Utah.—An electric light and power company has been organized. It is headed by C. E. MAYNE, of Omaha, Neb.

Helena, Mont.—The following proposals have been received by Mr. A. C. BOTKIN, City Clerk: Helena Power & Light Co., $16.50 per light per month; Citizens Electric Light Co., $17. The contract was awarded to the former.

Petaluma, Cal.—The Petaluma Electric Light Co. has been incorporated with a capital stock of $10,000. The directors are: GEO. B. CODDING, W. S. PIERCE, J. H. BEGGS, and S. H. TAYLOR. The object is to supply Petaluma with electricity, the former company having dissolved.

SEWERAGE AND MUNICIPAL.

Sewerage.—***White Plains, N. Y.***—The Board of Trustees has instructed H. J. DYKMAN to take immediate steps to have a commission appointed to condemn lands for sewerage purposes.

Potsdam, N. Y.—An appropriation of $1,500 has been made for a drain on Clinton St.

Buffalo, N. Y.—The Common Council intends to order 10 and 12 in. tile sewers laid on several streets.

Newark, N. J.—The mayor in his message, alludes to the matter of the city's sewers, and speaks of the folly of laying small pipe sewers. He adds: "I think no sewer should be laid or constructed in any street in this city of a size that will not allow a person to pass through and inspect it or clear it if necessary, and provisions should be made for the disposal of the storm water."

Atlanta, Ga.—Mr. HAAS chairman of the Sewer Committee, showed in his report that $47,500 had been appropriated for main or trunk sewers and $50,000 for assessment sewers, making a total of $97,500. Of this amount $87,661 62 had been expended. The average cost of the sanitary or pipe sewers was about $1 25 per lin. ft., of trunk or main sewers $4 per lin. ft. The total mileage of sewers laid in 1889 was 7.10 against 2.14 in 1888. The report shows that 200 miles of sewers will be required to complete the system. Mr. HAAS is preparing a number of ordinances for sewers. The work is all being done in accordance with the plans laid down by Mr. HERING, Consulting Engineer, and Mr. CLAYTON, City Engineer.

Akron, O.—The sewers are to be extended and repaired during the spring.

Findlay, O.—It is stated that a system of sewers is likely to be built next season.

Urbana, O.—There has been some talk of putting in a system of sewers, but no definite action has yet been taken.

Sioux City, Ia.—Mr. C. F. LOWETH, of St. Paul, the engineer for the Jackson St., sewer has been investigating the question of converting Perry creek into a sewer.

Oakland, Cal.—A vote on the proposition to issue bonds for sewers, salt water distribution, electric lighting, etc., will probably be taken in March.

Gas Lighting.—***Brooklyn, N. Y.***—The proposals received by the Commissioners of City Works last week were as follows: The Metropolitan, People's, Nassau, Citizen's, and Brooklyn gas companies bid $22 per lamp; Williamsburg Gas Co., $21.75.

New Orleans, La.—The city has granted a franchise to the company organized by L. E. LEMAIRE and others to build works for the manufacture of fuel gas. The company is to begin work within one year after the signing of the contract. The estimated cost of the work is $2,000,000.

Street Work.—***Portland, Me.***—An order has been passed authorizing the committee on streets, sidewalks, and bridges to advertise for proposals for granite blocks sufficient to lay about 10,000 sq. yds., the same to be paid for when laid on the streets and surveyed by the City Engineer: provided, however, that no part of the purchase money shall be paid until after the appropriations are made for 1890-91. Also to advertise for proposals for 5,000 tons of granite fronting material, for use in the year 1890, with the same limitation with regard to payment.

Poughkeepsie, N. Y.—The Board of Trade will hold a public meeting for considering methods for the improvement of the streets.

Buffalo, N. Y.—The Common Council intends to order the laying of A. L. Barbers Trindad asphalt paving and second-class Medina sandstone paving on several streets. For particulars address the City Engineer. Mr. MANN, Asheville, N. C. The city has appointed a committee to examine the merits of P. M. B. YOUNG'S system of street paving with vitrified brick, with a view to its adoption.

Savannah, Ga.—An appropriation of $10,000 has been made for streets and $8 000 for asphalt paving.

Zanesville, O.—The question of street paving is being discussed by the Board of Trade.

Alpena, Mich.—The Common Council has instructed the Comptroller to advertise for bids for laying a large amount of cedar block pavement, work to be done the coming summer.

Denver, Col.—The residents on 15th St, want asphalt paving on that street.

Water Power.—Mr. J. T. FANNING, of St. Paul, Minn., will probably prepare plans for the utilization of the power of the Colorado River at Austin, Tex.——A syndicate, headed by C. E MAYNE, of Omaha, Neb., will build a dam at Ogden, Utah, for storing water for power purposes.

WATER-WORKS.

NEW ENGLAND.

Boston, Mass.—Bids were received on Jan 13, for $100,000 of 3½ per cent. Cochituate water loan bonds, due and payable Jan. 1, 1920.

MIDDLE.

Altamont, N. Y.—The railroad Co. is anxious to have a system of works constructed and has offered to pay a good per cent. on the investment. Water is now obtained from wells.

Brooklyn, N. Y.—At a recent meeting of the Board of Aldermen, a letter was read from GEORGE C. EVANS, President of the Ramapo Water Supply Co., asking the Common Council to again consider the proposition made to the city some time ago. The company proposes to bring water from Orange and Rockland Counties.

Rochester, N. Y.—Alderman SELYE who has visited several cities to investigate the question of economy from the use of meters, has made the following statement:

It was the unanimous opinion that Rochester's water supply is more than adequate to the demands of a population of 135,000, provided that the economy which always results from the use of meters was observed.

Potsdam, N. Y.—A duplex steam pump and boiler will be purchased by the Water Commissioners. The pumping plant is to be established to keep up the water supply while the two dams are being rebuilt. Contracts for rebuilding these dams will probably be let within 90 days. The Commissioners are: GEO. LEWIS, W. H. WALLING, and GEO. B. RAYMOND.

Newark, N. J.—In the report of the Aqueduct Board for 1889, the Superintendent recommends the following improvements:

That a new 24-in. distributing main be laid from the low service reservoir during the year. Also the building of

a storage reservoir and the laying of a new supply main from the Belleville reservoir. The former to be proceeded with without delay. It will occupy about two years, and ought to be completed by the time the new water supply is completed in 1892.

Elizabeth, N. J.—A new company has been organized and will soon begin the construction of a new system of works. The plan is to furnish the water from artesian wells, and a tract of land at South Elizabeth has been secured where the wells will be driven. Among those said to be interested in the enterprise are: Sheriff GLASBY, ex-Congressman CLARK and F. D. THOMAS, a Mechanical Engineer, who is reported to be the projector of the company. The company now operating works in the city has until recently been controlled by JOSEPH BATTIN. They are now owned by ex-Congressman JOHN KEAN, Jr.

Mansfield, Pa.—H. A. ELLIOTT has sent us the following:

The question of constructing works is being agitated, but the matter has not taken any specific form. Probable cost if constructed, $40,000. Water would probably be pumped to a reservoir. Population, 2,500.

Curwensville, Pa.—The following is from F. I. THOMPSON:

Shafer & Thompson have been awarded the contract for constructing a gravity system of works. The proposed source of supply is springs. Work will be commenced in May and is to be completed in September. Population, 2,000.

SOUTHERN.

Bon Air, Va.—We have received the following information from T. M. V. TALCOTT:

A charter for a company was obtained, but none has yet been organized.

Weston, W. Va.—W. J. KITSON sends us the following:

Plans are being prepared by W. J. KITSON, but have not been completed in detail. The works will be built by a private company. Water will be pumped from the river to a reservoir, and be used for fire protection and domestic purposes.

Hendersonville, N. C.—Regarding the new works V. L. HYMAN, Chairman of the Water Board, sends us the following:

Pipe will be laid early in the spring. The reservoir is nearly completed. The works are being constructed by the town, and will be completed in June. Estimated cost, $20,000; procured by bonds. Water will be conveyed from a leased spring to a reservoir, by gravity. Designing Engineer, GATHON ANDERSON. Engineer in charge of surveys, S. J. JUSTICE.

Lincolnton, N. C.—H. E. RAMSOUR informs us that the project to construct works has been abandoned.

Reidsville, N. C.—Bids for constructing works are wanted by A. H. MOTLEY, Jr.

Rutherfordton, N. C.—The following information is from G. W. HODGE:

Bonds have been voted, and contracts for a small system of works will be let as soon practicable. Water will probably be pumped from a small stream to a tank.

Anderson, S. C.—Works are being constructed by the Anderson Water Supply Co., W. C. WHITNER, Agent. The contract was let in November, 1889. Water will be pumped from Generostu Creek to a reservoir. Hydrants will be used. Population, 3,800.

Waycross, Ga.—We have received the following information from H. W. REED:

At a recent election the town voted to issue $30,600 of bonds for constructing works. Water Commissioners have been appointed, H. MURPHY, Chairman, and preparations are now being made to prepare plans for the works. No Designing Engineer has been appointed. H. W. REED is the Engineer in charge of surveys. The supply will be taken from deep wells. Hydrants will be used. Population about 4,500.

Piedmont, Ala.—The Piedmont Land & Improvement Co. will proceed at once to build works. Mr. LEE, of Wilmington, Del. is President.

Bridgeport, Ala.—The Bridgeport Land & Improvement Co. will receive proposals for constructing works.

Spring Garden, Ala.—The new works were put in operation Oct. 1, 1889.

Durant, Miss.—Regarding the notice that a small system of works had been established by the Illinois Central R. R., R. B. CARSON sends us the following:

A small system of works has been established for the company's use. The company has since offered to allow the city to use its tank and pumps, in case of fire, provided the city will establish hydrants, etc., throughout the city. This proposition is now being considered by the city.

Mayfield, Ky.—A. B. CARLIN, City Clerk, informs us that the Commonwealth Construction Co., of Philadelphia, Pa., has the management of the works now being constructed.

Middlesborough, Ky.—It is reported that ISAAC CASSIN, of Philadelphia, Pa., is arranging for the establishment of works.

Hopkinsville, Ky.—A. H. Kennedy, of Rockport, Ind., who has been awarded the contract for constructing works by the city, sends us the following information:

The works will be built this season. No contracts for supplies, etc., have been let. Water will be pumped by a 350,000-gall. engine, from a reservoir, formed by constructing a dam across the Little River, to a standpipe, 20 ft. in diameter by 100 ft. high. There will be 9 miles of 12 to 4-in. cast-iron pipe, and 75 hydrants. Population, 8,500.

Shelbyville, Ky. — T. J. RAMSEY sends us the following:

Application for a charter from the Legislature is to be made this winter.

NORTH CENTRAL.

Bucyrus, O.—The company is making additions to their building, and putting in new and larger pumping engines.

Van Wert, O.—W. B. JONES, Clerk of the Board, sends us the following information:

Contracts for constructing works will probably be let about June 1. Estimated cost, $75,000. The supply will be taken from wells. J. O. BROWDER is Mayor.

Franklin, Ind.—FRANK MCCULLOUGH, City Clerk, has sent us the following:

The city contracted with Indianapolis parties last year for works to be completed Dec. 18. The company allowed the time to lapse without beginning the work, and nothing has yet been done.

Huntingburg, Ind.—We have received the following from JAMES MURRAY:

No contracts have yet been made. The City Council now has the matter under consideration, and it is probable that works will be constructed this summer. The estimated cost is $30,000. The supply would be taken from the Palatka River. E. R. BRUNDICK, Mayor, may be addressed for information. Population, 3,500.

Elk Rapids, Mich.—We have received the following information from J. W. DAVIS.

If works are constructed, the contract will probably be let to M. B. Lang. Capital is ready, and the development of the project is awaiting the action of the Water Board. The proposed source of supply is Elk Lake. The date for letting contracts has not been decided upon. Population, 1,200.

Mio, Mich.—JOHN RANDALL, Secretary and Superintendent, informs us that about 1,000 ft. of pipe will be laid. The existing works were constructed by the Mio Water Co. in 1889. Water is pumped from Spring Creek to a reservoir.

Iron Mountain, Mich.—R. SHERWOOD states: "We are advertising to grant a franchise to company that will put in works." The proposed plan is to pump water from the river, 2 miles distant, to a reservoir. J. H. SANDUCOCK is Chairman of the Water-Works Committee.

Belleville, Ill.—The dam at the upper reservoir is to be repaired.

Buckley, Ill.—J. M. LINDENMEYER, Village Clerk, sends us the following:

The village did not have sufficient funds to lay mains along the streets last year, and it is the intention to complete this work this season. Water is now used for fire protection only.

Avondale, Ill.—F. E. THOMTON, informs us that work will probably be begun on the plant to supply the town with water, via the Chicago works, in the spring.

Carrollton, Ill.—We have received the following information from H. EBERLIN:

An artesian well is now being sunk by H. H. Gray & Co., of Chicago, Ill. The question of issuing bonds and erecting works will be submitted to the legal voters on April 22. Estimated cost, 22,000. The proposed plan is to pump the artesian well water to a tank. Population, 2,500.

Murphysboro, Ill.—W. M. BROWN, City Clerk, has sent us the following:

Kennedy & True have been awarded the contract for constructing works, and work has been commenced. Plans and specifications were prepared by Professor J. B. JOHNSON, of St. Louis, Mo. The franchise was granted to, and the works are being constructed by, the Murphysboro Water-Works, Electric & Gas Light Co. W. K. MURPHY is President. The city will pay an annual rental of $3,000. Water will be pumped from the Big Muddy River to a stand-pipe, 150 ft. high by 15 ft. in diameter. Estimated cost, $115,000.

Belleville, Ill.—The Board of Water Commissioners estimate that by establishing a pumping plant in connection with the artesian well, that 400,000 galls. of water can be obtained daily. The well is 2,343 ft. deep, and is flowing 125,000 galls of water daily.

Pekin, Ill.—The City Council has ordered the company to lay mains in the third ward.

Canton, Ill.—The old boiler has been taken out of the engine house, and workmen are engaged on the foundation for the new building and boiler. Recent experience has shown the absolute necessity of having the whole pumping system in duplicate.

Eagle River, Wis.—GEO. P. DICKISON has sent us the following:

M. HOLLAND is Chairman of the Water Board, and may be addressed for information regarding the new works now being established for fire protection only. Hydrants will be used. Water will be pumped from the river to a stand-pipe. Estimated cost, $10,000, procured by taxation. Population, 1,000.

Milwaukee, Wis.—The Committee on Water Works has recommended making an appropriation of $7,000 for the Board of Public Works, to be used in carrying on the work of laying and repairing the water mains. The following communication was presented:

As contemplated water mains will be laid during the coming season, it will be necessary to place at the disposal of the board the required water gates and special casting, such as four-way and three-way reducers, branches, plugs, bends, etc. Exactly what is required cannot be determined in advance, and consequently it is impossible to furnish specifications for guidance of bidders. We therefore recommend that authority be granted this board to purchase the materials, without a formal contract, from time to time, as the necessity arises, to an amount not exceeding $7,000.

NORTHWESTERN.

St. Paul, Minn.—The contracts for work and material for the extension for 1890 have been awarded as follows: Pipe, Shickle, Harrison & Howard Iron Co., of St. Louis, Mo., $120,000; valves, Galvin Brass & Iron Works, of Detroit, Mich., $4,500; brass goods, Mueller Mfg. Co., of Decauter, Ill., and H. P. Rugg & Co., of St. Paul, $1,000. [Our notice of contracts awarded at his place, in our last issue referred to Minneapolis instead of St. Paul.—ED.]

Fairbury, Neb.—The new works have been accepted by the city.

Fort Scully, Dak.—D. F. ANGLUM, Second Lieut. 12th Infantry, Post Q. M. sends us the following:

Bids are wanted for constructing works. Contracts will be let on Feb. 15. The proposed plan is to pump water from the Missouri River to a tank. The works will be built by the U. S. Government. Estimated cost, $10,000.

SOUTHWESTERN.

St. Louis, Mo.—An ordinance has been introduced authorizing the completion of the low-service conduit to the Chain of Rocks, at a cost of $210,000.

Pueblo, Col.—The trustees have entered into an agreement to at once extend the water mains to Central Park, at Grand View Place, Fairmount Park, and Mountain View. The contract has been let, and the pipe ordered.

PACIFIC.

Tacoma, Wash.—The company expects to expend $500,000 in extending and improving its plant during the coming season.

North Yakima, Wash.—Propositions looking to the construction of works have been submitted to the people, and final action will be taken soon. As projected the system consists of 4 miles of mains and 25 hydrants. The water will propably be pumped from the Natchez River, at a point about 2 miles distant from the city.

Sehome, Wash.—The Bellingham Bay works are nearly completed. Total cost, $80,000. They are being constructed by the Coruwall Railroad Co.

Sumner, Wash.—The Sumner Light & Water Co. has been incorporated at Olympia to build works. The trustees are: E. C. MEAD, JOHN F. KINCAID, L. F. THOMPSON, W. R. LINDSAY, and GEO. H. RYAN. Capital stock, $40,000.

Ellensburgh, Wash.—The Mayor has approved the ordinance granting to a private individual the franchise of supplying the city with weter.

Santa Barbara, Cal.—A special election was held on Jan. 4 to decide the question of bonding the city for $200,000 for obtaining the city's water supply from the Santa Cruz River, by tunneling the mountains.

Menlo Park, Cal.—The Menlo Park Water Co., has been dissolved and reincorporated under the name of the Bear Gulch Water Co. The capital stock has been increased from $100,000 to $500,000. The members of the Board of Directors are: JAS. L. FLOOD, GEO. R. WELLS, C. N. FELTON, CON. O'CONNOR, R. H. FOLLIS. Extensive improvements will shortly be made, including the laying of new mains to Menlo Park, and the construction of a large dam.

Los Angeles, Cal.—URI EMBODY, representing a syndicate, has applied to the City Council for the passage of an ordinance granting a franchise to a new company having a capital stock of $3,000,000. If the ordinance is passed work will be begun within 30 days after that date.

Projects have been mentioned in the following places: —Lexington, Ga., W. A. Shackelford.—Claude, Tex.

CANADA.

Ingersoll, Ont.—Water rights have been purchased by Mr. FREEMAN, of Watertown, N. Y., for the new works. Marsden Springs will furnish the principal source of supply. The storage supply will be taken from King's Pond.

FOREIGN.

London, England.—Water-Works, Manufacturers of water pipings, fittings, etc., are requested to send in their names by letter to Water-Works, care of J. W. VICKERS, Nicholas Lane, London.

ARTESIAN WELLS.

St. Augustine, Fla.—The St. Augustine Laundry & Dye Works is sinking a well.

Santa Fè, N. M.—The experimental well has reached a depth of 500 ft. and water now rises to within 100 ft. of the surface.

IRRIGATION.

Sante Fè, N. M.—The Una de Gato Irrigation Co., in which Col. W. J. DWYER of Colfax County is the leading spirit, has organized a corps of engineers at Raton to survey a line for an extensive irrigating canal and water storage system in Johnson's Park, Colfax County. The supply will be taken from Una de Gato Creek. Work is to be pushed as rapidly as possible and its completion will put 50,000 acres of good farming land upon the market.

Santa Fé, N. M.—The Taos & Red River Canal Co. has filed articles of incorporation. It is designed to to take water from the Red River, and irrigate 60,000 acres of land in Taos valley. Capital stock, $300,000, of which $40,000 has been taken by residents of this territory and St. Louis parties. Governor PRINCE is President, and JOHN H. YOUNG of Cerro, is General Manager.